BIBLIOGRAPHY OF ZIRCONIUM

BY ELEANOR ABSHIRE

Information Circular 7771

UNITED STATES DEPARTMENT OF THE INTERIOR
Fred A. Seaton, Secretary
BUREAU OF MINES
Marling J. Ankeny, Director

Work on manuscript completed June 1955. The Bureau of Mines will welcome reprinting of this paper, provided the following footnote acknowledgment is made: "Reprinted from Bureau of Mines Information Circular 7771."

The work upon which this report is based was done under a cooperative project by the Bureau of Mines, United States Department of the Interior, and the Bureau of Ships, Department of the Navy.

March 1957

Generated on 2024-09-20 18:02 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Bureau of Mines
Information Circular 7771

BIBLIOGRAPHY OF ZIRCONIUM

by

Eleanor Abshire

ERRATA

Please make the following changes in the above Information Circular:

Page 36. Abstracts 148 and 149 omitted.

148. DANKS, W. D. Additions of Zirconium and Rare Earths Extend Magnesium's Range of Applications. Modern Metals, vol. 6:4, May 1950, pp. 34-36.

The advent of jet propulsion created an immediate need for ultralight alloys. This need has been met by magnesium alloys Z5Z and ZRE1, which were developed by Magnesium Elektron and are now being cast by Howard Foundry Co. in its Chicago plant. Almost all of Howard's production in these alloys has gone into jet engines, such as Pratt & Whitney's new J-48. Howard engineers believe, however, that Z5Z and ZRE1 offer possibilities for other industries.

149. DASHER, J., FRAAS, F. AND GABRIEL, A. Mineral Dressing of Oregon Beach Sands - Concentration of Chromite, Zircon, Garnet and Ilmenite. Bureau of Mines Rept. of Investigations 3668, 1942, 19 pp.

On the coast of southwestern Oregon, particularly in Coos and Curry Counties, are numerous pockets of heavy sand that have been deposited on the back of old beaches. Sediments have covered the deposits, but outcrops are to be found along creek beds. The total tonnage has not been estimated. Samples from various places along 44 miles of coast have been tested. This report discusses deposits, separations, tabling, cleaning surfaces, and results of experiments.

Page 36. Add: DAMIANO, V. See abs. 180.

Page 199. Abs. 976 should be Abs. 965.

INT.-BU.OF MINES,PGH.,PA. 8565

Generated on 2024-09-20 18:10 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

BIBLIOGRAPHY OF ZIRCONIUM

by

Eleanor Abshire[1]/

CONTENTS

	Page
Introduction	ii
Selected abbreviations	1
Journal references	4
Patents	201
Subject index	243
Patent subject index	271

1/ Librarian, Region I, Albany, Oreg., assisted by Helen L. Dreher, library assistant.

Information Circular 7771

Generated on 2024-09-20 18:05 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

INTRODUCTION

This bibliography is the result of a cooperative project undertaken by the Bureau of Ships and the Bureau of Mines to accumulate literature published to date on zirconium and hafnium and to establish an information center on these metals for the use of any interested research organization or library.

This bibliography, which will be supplemented as additional information is accumulated, consists of references, with abstracts, to pertinent literature on the subject published from 1907 to date.

The following reference sources have been used: ASM Metals Review; ASTIA Index; AEC (Oak Ridge) TID Index; Battelle Technical Review; Bibliography of Technical Reports; British Abstracts; Chemical Abstracts; Crerar Metal Abstracts; Current List of Medical Literature; Education Index; Engineering Index; Industrial Arts Index; Nuclear Science Abstracts; Quarterly Cumulative Index Medicus; and Readers' Guide.

The material in this bibliography is divided into two sections, literature and patents. Each section is arranged alphabetically by authors. Secondary authors are cross-indexed. Titles of periodicals or organizations are used as the authors in anonymous references.

Special acknowledgment is due to Louise M. Milligan, head, Interlibrary Loan Section, Oregon State College, Corvallis, Oreg., for many hours of reference assistance; and to Glen C. Ware, chief, Branch of Technical Services, Bureau of Mines, Region I, for final review of the manuscript.

Generated on 2024-09-20 18:07 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

SELECTED ABBREVIATIONS

Acta Cryst.	Acta Crystallographica
Acta Met.	Acta Metallurgical
Aeronau. Research Lab.	Aeronautical Research Laboratory
Am. Ceram. Soc. Bull.	American Ceramic Society Bulletin
Am. Dyestuff Reporter	American Dyestuff Reporter
Am. Inst. Min. and Met. Eng.	American Institute of Mining and Metallurgical Engineers
Am. Jour. Sci.	American Journal of Science
Am. Machinist	American Machinist
Am. Metal Markets	American Metal Markets
Am. Miner.	American Mineralogist
Am. Soc. Metals	American Society for Metals
Anal. Chem.	Analytical Chemistry
Anal. Chim. Acta	Analytica Chimica Acta
Appl. Sci. Research	Applied Scientific Research
Astrophys. Jour.	Astrophysical Journal
Australasian Eng.	Australasian Engineer
Batelle Tech. Rev.	Battelle Technical Review
British Intell. Objectives Sub-Comm.	British Intelligence Objectives Sub-Committee
British Jour. Ind. Medicine	British Journal of Industrial Medicine
Bull. Am. Ceram. Soc.	Bulletin American Ceramic Society
Bull. Am. Phys. Soc.	Bulletin American Physical Society
Canadian Inst. Min. and Met.	Canadian Institute of Mining and Metallurgy
Canadian Jour. Chem.	Canadian Journal of Chemistry
Canadian Min. Jour.	Canadian Mining Journal
Ceram. Age	Ceramic Age
Ceram. Bull.	Ceramic Bulletin
Ceram. Soc.	Ceramic Society
Chem. Age	Chemical Age
Chem. and Industry	Chemistry and Industry
Chem. Eng.	Chemical Engineering
Chem. Eng. and Min. Rev.	Chemical Engineering and Mining Review
Chem. Eng. News	Chemical Engineering News
Chem. Eng. Prog.	Chemical Engineering Progress
Chem. in Canada	Chemistry in Canada
Chem. and Process Eng.	Chemical and Process Engineering
Chem. Week	Chemical Week
Col. Geol. and Miner. Resources, Great Britain	Colonial Geology and Mineral Resources Great Britain
Colorado Min. Assoc.	Colorado Mining Association
Commonwealth Sci. and Ind. Research, Div. Chem., Melbourne, Australia	Commonwealth Scientific and Industrial Research, Division of Chemistry, Melbourne, Australia
Compt. rend. acad. sci. U.R.S.S.	Comptes rendus (Doklady) de l'académie des sciences de l'U.R.S.S.

Generated on 2024-09-20 18:07 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Elec. Mfg.	Electrical Manufacturing
Electrochem. Jour., Japan	Electrochemical Journal, Japan
Electrochem. Soc.	Electrochemical Society
Eng. and Min. Jour.	Engineering and Mining Journal
Eng. Expt. Sta. News	Engineering Experiment Station News
Geochim. Cosmochim. Acta, London	Geochimica et Cosmochimica Acta, London
Glass Ind.	Glass Industry
Gmelin's Handbook Inorg. Chem.	Gmelin's Handbook of Inorganic Chemistry
Ind. Eng. Chem.	Industrial and Engineering Chemistry
Inst. Chem., Ukrainian S.S.R.	Institute of Chemistry of Ukrainian S.S.R.
Inst. Gen. and Inorg. Chem., Sweden	Institute of General and Inorganic Chemistry, Sweden
Inst. Miner. Raw Materials, Russia	Institute of Mineral Raw Materials, Russia
Inst. Phys. and Chem. Research, Japan	Institute of Physical and Chemical Research, Japan
Inst. Sci. and Technol., Japan	Institute of Science and Technology, University Tokyo, Japan
Jour. Am. Ceram. Soc.	Journal, American Ceramic Society
Jour. Am. Chem. Soc.	Journal, American Chemical Society
Jour. Am. Leather Chemists' Assoc.	Journal, American Leather Chemists' Association
Jour. Appl. Chem. (U.S.S.R.)	Journal of Applied Chemistry (U.S.S.R.)
Jour. Appl. Phys.	Journal of Applied Physics
Jour. Chem. Education	Journal of Chemical Education
Jour. Chem. Phys.	Journal of Chemical Physics
Jour. Econ. Entom.	Journal of Economics Entomology
Jour. Electrochem. Soc.	Journal of Electrochemical Society
Jour. Elisha Mitchell Sci. Soc.	Journal of Elisha Mitchell Scientific Society
Jour. Franklin Inst.	Journal of Franklin Institute
Jour. Geol. Min. Met. Soc., India	Journal of Geological Mining Metallurgical Society, India
Jour. Inst. Metals	Journal, Institute of Metals
Jour. Iron and Steel Inst.	Journal, Iron and Steel Institute
Jour. Metals	Journal of Metals
Jour. Optical Soc. America	Journal, Optical Society of America
Jour. Pharmacol. and Exper. Therapeutics	Journal of Pharmacology and Experimental Therapeutics
Jour. Phys. Soc., Japan	Journal of Physical Society of Japan
Jour. Sci.	Journal of Science
Jour. Washington Academy of Sci.	Journal of Washington Academy of Sciences
Mech. World	Mechanical World
Metal Ind.	Metal Industry
Metall. und Erz.	Zeitschrift für Erzbergbau and Metallhuttenwesen
Metals Rev.	Metals Review
Metals Trans.	Metals Transactions
Midwest Eng.	Midwest Engineer
Min. and Met.	Mining and Metallurgy
Min. Cong. Jour.	Mining Congress Journal
Min. Eng.	Mining Engineer
Min. Jour.	Mining Journal
Min. Mag.	Mining Magazine
Miner. Mag.	Mineralogical Magazine
Mines Mag.	Mines Magazine
Monthly Bus. Rev.	Monthly Business Review

Generated on 2024-09-20 18:11 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Nat. Advisory Comm. Aeronau.	National Advisory Committee for Aeronautics
Nat. Bureau of Standards, Research Jour.	National Bureau of Standards, Research Journal
Phil. Mag.	Philosophical Magazine
Phys. Rev.	Physical Review
Phys. Soc. London	Physical Society of London
Proc. Am. Acad. Arts and Sci.	Proceedings, American Academy of Arts and Sciences
Proc. Indian Acad. Sci.	Proceedings, Indian Academy of Sciences
Proc. Roy. Soc., London	Proceedings, Royal Society, London
Prod. Eng.	Product Engineering
Powder Met. Bull.	Powder Metallurgy Bulletin
Queensland Govt. Min. Jour.	Queensland Government Mining Journal
Rec. trav. chim.	Recueil des travaux chimiques des Pays-Bas
Refractories Jour.	Refractories Journal
Rev. Sci. Instruments	Review of Scientific Instruments
Sci. Am.	Scientific American
Sci. and Mech.	Science and Mechanics
Sci. News Letter	Science News Letter
Soc. Exper. Biol. and Med.	Society for Experimental Biology and Medicine
South African Min. Jour.	South African Mining Journal
Steel Process.	Steel Processing
Trans. Am. Foundrymen's Soc.	Transactions, American Foundrymen's Society
Trans. Am. Inst. Min. Met. Eng.	Transactions, American Institute of Mining and Metallurgical Engineers
Trans. Am. Soc. Mech. Eng.	Transactions, American Society for Mechanical Engineers
Trans. Am. Soc. Metals	Transactions, American Society for Metals
Trans. Electrochem. Soc.	Transactions, Electrochemical Society (Formerly, American Electrochemical Society)
Trans. Faraday Soc.	Transactions, Faraday Society
Trans. Indian Ceram. Soc.	Transactions, Indian Ceramic Society
Welding and Metal Fab.	Welding and Metal Fabrication
Welding Jour.	Welding Journal
Wire and Wire Prod.	Wire and Wire Products
Zhur. Priklad. Khim.	Zhurnal Prikladnoy Khimii
Zhur. Tekh. Fiz.	Zhurnal Tekhnicheskoĭ Fiziki
Ztschr. anorg. Chem.	Zeitschrift für anorganische Chemie
Ztschr. Metallkunde	Zeitschrift für Metallkunde
Ztschr. physik. Chem.	Zeitschrift für physikalische Chemie

Generated on 2024-09-20 18:06 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

JOURNAL REFERENCES

AARON, D. See abs. 475.

1. ABATE, L., AND WILHELM, H. A. Sublimation of Zirconium Tetrafluoride. Ames Lab., Iowa State College, ISC-151, March 1951, 35 pp.

The demand for a dense zirconium tetrafluoride of high purity for use in preparing zirconium metal can be met by vacuum sublimation of zirconium fluoride prepared by the precipitation and dehydration method. Zirconium fluoride was separated from less volatile metallic impurities, moisture, and nonvolatile zirconium compounds in this manner. The degree of separation of the desired product improved with the lower sublimation temperatures; the lowest temperature was 750° C. Some fractionation from hafnium also occurred at this temperature, but zirconium tetrafluoride was the more volatile so a complete separation of zirconium from hafnium by sublimation does not seem practical. In view of the rate of sublimation, purity of product obtained, and time required, the optimum operating temperature would be about 800°-850° C. with a pressure of approximately 300 microns. At higher temperatures the vapor pressures of the impurities become appreciable, thus contaminating the product. With lower operating temperatures, the time required for complete sublimation increases rapidly.

ACHERMAN, W. L. See abs. 262, 263, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 517.

ACHERMAN, W. R. See abs. 267, 268, 270, 271, 272, 273, 274, 275, 276.

ACHERMAN, W. R. See abs. 265, 266.

ADAMS, G. B., JR. See abs. 566.

ADAMS, G. B., JR., MARAGHINI, M., AND van RYSSELBERGHE, P. Electrochemical and Polarographic Studies on the Corrosion of Zirconium in Presence of Various Aqueous Media - Progress Report. See abs. 913.

ADAMS, M. See abs. 657.

ADAMS, W. S. See abs. 309.

ALEXANDER, B. H. See abs. 84.

2. ALEXANDROV, G. P. /Decomposition of Zircon by the Chlorination Method./ Ukrainian Chem. Jour., vol. 11, 1936, 13 pp.

The method of decomposing by chlorination at high temperatures can be applied to briquettes made of zircon. When the zircon is sufficiently finely ground, the yield reaches 90 percent in the small-size laboratory tests and 90 percent on an enlarged scale. The optimum chlorination temperature of zircon is 750°-800° C. When the mineral zircon is decomposed by the chlorination method, the zirconyl chloride is readily obtained from the evaporated solution. Ninety-one percent is assumed to be the yield of zirconyl chloride from the solution. Russian silica is peculiar in that it does not chlorinate.

3. ALFORD, W. C., SHAPIRO, L., AND WHITE, C. E. Fluorometric Determination of Zirconium in Minerals. Anal. Chem., vol. 23, No. 8, August 1951, pp. 1149-1152.

The increasing use of zirconium in alloys and in the ceramics industry has created renewed interest in methods for its determination. It is a common constituent of many minerals, but is usually present in very small amounts. Published methods tend to be tedious, time-consuming, and uncertain as to accuracy. A new fluorometric procedure, which overcomes these objections to a large extent, is based on the blue fluorescence given by zirconium and flavonol in sulfuric acid solution. Hafnium is the only element

Generated on 2024-09-20 18:06 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

that interferes. The sample is fused with borax glass and sodium carbonate and extracted with water. The residue is dissolved in sulfuric acid, made alkaline with sodium hydroxide to separate aluminum, and filtered. The precipitate is dissolved in sulfuric acid and electrolyzed in a Melaven cell to remove iron. Flavonol is then added and the fluorescence intensity is measured with a photofluorometer. Analysis of seven standard mineral samples shows excellent results. The method is especially useful for minerals containing less than 0.25 percent zirconium oxide.

4. ALIMARIN, J. P., AND FRID, B. I. /Quantitative Separation of Niobium (Columbium) and Tantalum from Titanium and Zirconium by Means of Pyrogallic Acid./ Zavadskaia Lab. (Russian), vol. 7, No. 2, July-December 1938, pp. 1109-1116; Department of Commerce, Office of Tech. Services, NP-2279.

For determining columbium (niobium) and tantalum in the presence of titanium and zirconium, a new method of separation using pyrogallic acid is offered. The acid in the hydrochloric acid medium forms with titanium and zirconium complex compounds which dissolve readily, and at the same time the columbium and tantalum are separated as insoluble pyrogallates. The method of analysis recommended for columbic-tantalic minerals is as follows: The samples are broken up by fusion with pyrosulfate of potassium or with a mixture of sulfuric and hydrofluoric acids. After this, the columbium and tantalum are separated from the other elements with pyrogallol and are precipitated by means of phenilarsinic acid.

ALLEN, C. M. See abs. 152.

5. ALLIBONE, T. E., AND SYKES, C. Alloys of Zirconium - I. Jour. Inst. Metals, No. 458, 1928, pp. 173-189.

Gives some physical properties of certain alloys of zirconium. The structures of partial series of the alloy systems copper-zirconium to 35 percent zirconium, nickel-zirconium to 55 percent zirconium and iron-zirconium to 30 percent zirconium are given. In each case the system is eutectiferous and intermetallic compounds are formed. In the copper-zirconium system the compound Cu_3Zr is found; in the nickel-zirconium system two compounds, probably Ni_3Zr and Ni_4Zr are found in the range of alloys investigated. The solid solubility of zirconium in the pure metals copper, nickel, and iron is in each case very small, that is, less than 0.5 percent. The measurements of hardness, tensile strength and ductility of certain alloys are recorded. The vacuum high-frequency induction furnace in which the alloys were made is described also.

6. SYKES, C. Alloys of Zirconium - II. Jour. Inst. Metals, No. 492, 1929, pp. 179-190.

Gives measurements of certain electrical and magnetic properties of copper-zirconium, iron-zirconium and nickel-zirconium alloys. These show that addition of zirconium leads to no material improvement in the properties of the metals and in certain cases is detrimental. Two further partial series of binary alloys are described - viz aluminum-zirconium and silver-zirconium. The systems exhibit little solubility in the solid state at room temperatures and intermetallic compounds are formed. In the low-percentage alloys - viz 10 percent - the compounds crystallize in the form of long, fine needles, and consequently the structure of the alloys is very coarse. Gives hardness figures for aluminum and silver-zirconium alloys, together with measurements of tensile strength, ductility, corrodibility and resistivity of the aluminum alloys.

7. ALNUTT, D. B., AND SCHEER, C. L. Zirconium Metal, Its Manufacture, Fabrication and Properties. Trans. Electrochem. Soc., vol. 88, 1945, pp. 195-205. Pres. at symposium on Electronics, Philadelphia, Pa., Oct. 17, 1945.

Generated on 2024-09-20 18:12 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Traces the major improvements in processes for purifying zirconium metal down to the present methods, which produce both powdered and massive metal of high purity. Discusses some of the problems involved in these methods and the manner of overcoming them. Describes the fabrication of ductile zirconium into wire and sheet. Summarizes the various properties of the ductile metal.

8. AMERICAN MACHINIST. How to Machine the Rarer Metals. Vol. 97, No. 8, Apr. 13, 1953, pp. 183, 185.

Increasing use of the rarer metals, among them tungsten, molybdenum, tantalum, titanium, and zirconium, for modern scientific and industrial application and the greater availability of these materials has necessitated research on optimum machining conditions. The tooling recommendations given here are based on tests carried out by Protolite, Ltd., Central House, Upper Woburn Place, London, WCI.

9. _____. What's Ahead the Next Ten Years in Metals. Vol. 96, No. 24, Mid-November 1952, pp. A2-A21.

A general survey of metals, plastics, electrical equipment, power-transmission equipment, hydraulics and pneumatics, lubrication, etc. (including zirconium).

10. AMERICAN METAL MARKETS. New Cleveland Firm to Make Zirconium Oxide. Vol. 60, No. 219, Nov. 13, 1953, p. 1.

A new Cleveland, Ohio, firm, Zirconium Corporation of America, will manufacture various zirconium compounds by a new process developed by Sylvester and Co., Cleveland.

11. AMES, B. N., AND KAHN, N. A. Gas Absorption Phenomena and Degasification of Cast Monel. Trans. Am. Foundrymen's Soc., vol. 55, 1947, pp. 558-570.

A study of the effect of various deoxidation treatments of cast Monel metal melted in the indirect and resistor furnaces was made. Magnesium is shown to be inadequate as a degaser in melting Monel metal in the indirect-arc furnace. Titanium, lithium, and zirconium deoxidation yielded satisfactory results. The increased solubility rate of certain gases upon melting nickel-copper in this unit is believed to be due to ionization of the furnace atmosphere. A possible explanation as to the phenomena involved is offered. The comparative beneficial effects on soundness while utilizing an air blast during melting in this unit is shown. The detrimental effects of nitrogen and hydrogen in cast Monel metal and the additions of titanium, lithium, or zirconium to prevent nitrogen porosity and of titanium to minimize hydrogen porosity are also shown. Comparative effects between the keel block test bar and another test bar in reflecting metal quality are presented.

12. AMSTUTZ, G. C. Geochemistry of Swiss Lavas. Geochim. Cosmochim. Acta (London), vol. 3, 1953, pp. 157-168.

Samples of Swiss permocarboniferous lavas have been examined by spectrochemical methods for mineralogical composition and geochemistry of a number of elements, including zirconium.

ANDERSON, C. T. See abs. 503.

13. ANDERSON, H. C., AND BELZ, L. H. Factors Controlling the Combustion of Zirconium Powders. Jour. Electrochem. Soc., vol. 100, No. 5, May 1953, pp. 240-249.

The activity of zirconium metal powders was studied by measuring ignition temperature, burning time, and ignition energy on subsieve powders prepared by calcium reduction of ZrO_2 and on coarse powders made by grinding fused zirconium. Particle diameter of 10 microns represents approximately the dividing line between hazardous and nonhazardous powder, using 0.01-0.04 joule spark ignition energy as a criterion. Thermal ignition appears to occur by spontaneous

Generated on 2024-09-20 18:05 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

combustion, and a theory was developed which accounts qualitatively for the dependence of ignition temperature on a number of variables. The burning time of Zr powders is related to, but not uniquely determined by, the surface area. Ignition sensitivity of Zr powders was not successfully decreased by alloying with Ti, Ni, Cu, Fe, Co, or H_2. Hazards are discussed briefly, and details of evaluation methods reported.

ANDERSON, H. H. See abs. 657.

14. ANDERSON, K., AND FLESHMAN, W. S. Reactivity of Titanium Hydride With Air. Ind. Eng. Chem., vol. 42, No. 7, July 1950, pp. 1381-1383.

A preliminary investigation of the rate of oxidation of the hydrides of tantalum, zirconium, columbium, and titanium in static laboratory air showed that titanium hydride was most resistant to oxidation. A further investigation of the reactivity of titanium hydride, using a dynamic method, indicated that with dried air, reaction rates decreased with increasing density and increased with increasing temperature and air-flow rate. The rate of reaction seemed to be strongly influenced by diffusional processes. Diffusion of decomposing hydrogen from within the pelletized sample and of atmospheric components across the gaseous boundary layer and into the sample were apparently important rate-determining processes.

ANDREW, K. F. See abs. 321, 322.

ANDREWS, A. I. See abs. 375, 482, 845, 846.

15. ANDREWS, A. I., AND GATES, R. W. Solubility of a Zirconium Oxide Opacifier in Enamel Glasses. Jour. Am. Ceram. Soc., vol. 23, No. 10, 1940, pp. 288-290.

The solubility of a zirconium oxide opacifier was determined by fusion in enamel glasses and then by heat treating at enameling temperatures and noting the amount of crystallization. An increase in the alumina, zinc oxide, and calcium oxide content in the glasses caused a decided decrease in the solubility of the zirconium oxide opacifier. The fusion temperatures of the enamels were raised by solution of zirconium oxide.

ANGIER, R. P. See abs. 359, 360, 460.

16. ARAKI, G. Interval Formula for Multiplets of Atomic Energy Levels. Physiol. Rev., vol. 72, 1947, pp. 1255-1256.

There are many cases in which intervals of multiplets do not satisfy the Landé rule; nevertheless the arrangement of the levels shows the Russell-Saunders coupling. The cause of such phenomena for lighter atoms was found to be due to spin-spin interactions between atomic electrons by detailed researches for triplets of the He atom, Be atom, and Be-like ions. It was also shown that spin-spin interactions can give rise to a deviation from the Landé rule even if the atomic number is large, because the effect of the atomic number is considerably reduced by spin-orbit interactions between atomic electrons. From the results of these researches it is probable that a spin-spin part of a multiplet-interval becomes, under certain circumstances, comparable with its spin-orbit part also for atoms with larger atomic numbers, although it is often accepted that the former is negligibly small compared with the latter. It is thus quite possible that some of irregular or even partly inverted multiplets of complex atoms belong to the Russell-Saunders case and that their deviations from the Landé rule can be attributed to spin-spin interactions as is in the case of lighter atoms. The calculated results are summarized and discussed.

17. ARMSTRONG, A. W. Tentative Equilibrium Diagram for the Nickel-Rich End of the Nickel-Zirconium System. Thesis, Oregon State College, June, 1953, 58 pp.

Generated on 2024-09-20 18:05 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The purpose of this investigation was to obtain an equilibrium diagram for the nickel-rich portion of the nickel-zirconium system by studying the effects of adding zirconium to nickel. The region studied included 100 percent nickel and alloys containing up to about 55 percent zirconium by weight.

18. ARNOLD, F. W., JR., AND CHANDLEE, G. C. Normal-Propylarsonic Acid as a Reagent for the Determination of Zirconium. Jour. Am. Chem. Soc., vol. 57, 1935, p. 8.

n-Propylarsonic acid has been shown to be a satisfactory reagent for the direct determination of zirconium in the presence of a number of elements, including tin, from which a separation has not heretofore been obtained by reagents of this type. Some properties of allylarsonic acid as an analytical reagent have been described.

ASCHOFF, W. A. See abs. 252.

19. ASTON, F. W. Constitution of Hafnium and Other Elements. Nature, vol. 133, May 5, 1934, p. 684.

The mass spectrum of hafnium indicates five isotopes. There is a weak line at 176 and four strong lines at 177, 178, 179, and 180. Observations for the elements thorium, rhodium, calcium, titanium, zirconium, and samarium are given. Palladium, iridium, platinum, and gold remain to be analyzed.

20. _____. Mass-Spectra of Chemical Elements - Part VI Accelerated Anode Rays Continued. Phil. Mag., vol. 49, 1925, pp. 1191-1201.

Further investigations by the method of accelerated anode rays are described by which the constitutions of 10 more elements, indium, barium, lanthanum, praseodymium, neodymium, cerium, zirconium, cadmium, tellurium, and bismuth, have been determined. Evidence is given for an additional isotope of strontium and isotopes of silicon and iron previously doubtful have been satisfactorily confirmed. Some results have been obtained from lead but are not considered conclusive. A general survey of the remaining elements is made, and the possibility of their analysis discussed. Gives a complete list of all isotopes so far determined.

21. ATOMIC ENERGY COMMISSION. Analysis of Zirconium Alloys. AECD-3457, undated. Decl. with deletions, Oct. 28, 1952, 5 pp.

Dissolution of zirconium and zirconium alloys is not a simple process. Both elemental zirconium and most of the zirconium alloys respond slowly to attack by a mixture of equal parts of nitric acid and hydrofluoric acid. Following either method of attack the resulting solution must be evaporated, with sulfuric acid, to copious fumes of sulfuric anhydride to completely remove all fluoride and nitrate. Neither elemental zirconium nor any of the zirconium alloys responded to fusion attack regardless of the flux selected.

AUER, M. I. See abs. 633.

22. AUGUSTSON, R. N. Constitution Diagram of the Copper-Zirconium Alloy System. Ames Lab., Iowa State College, Dec. 20, 1950, 64 pp. ISC-138; AECD-3456.

The major aims of this investigation were to determine the constitution diagram of the copper-zirconium alloy system in the zirconium-rich region and to evaluate the hardness properties of the alloys prepared. The following conclusions have been reached: 1. In the copper-zirconium alloy system, with zirconium content above 60 weight-percent, an intermetallic compound, identified as $CuZr_2$ and having a melting point of 1,065° C., was located at 73.6 percent zirconium. The crystal structure of this compound is body-centered tetragonal, with unit cell dimensions of c- 11.3 ± 0.2A and a- 3.3 ± 0.2A. 2. A eutectic between $CuZr_2$ and zirconium was located at 80.3 percent zirconium with a eutectic temperature of 998° C. 3. A

Generated on 2024-09-20 18:19 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

eutectoid was located at 95.0 ± 0.5 percent zirconium and 916 ± 15° C. 4. No pyrophoric alloys were encountered in the region studied. 5. Addition of even very small amounts of copper to zirconium gave an alloy harder than that of zirconium itself, and the hardness rose, in general, with increased copper concentration. 6. The extent to which oxygen has altered the various transformation temperatures therein reported or increased the hardness. Only the possibilities can be acknowledged at this time.

AULT, G. M. See abs. 408.

AUSTIN, C. R. See abs. 199, 829, 830, 831.

AUSTIN, E. See abs. 490.

23. AUSTIN, J. G. Thermal Expansion of Some Refractory Oxides. Jour. Am. Ceram. Soc., vol. 14, June, 1931, pp. 795-810.

The thermal expansion of crystals of alpha-alumina, magnesia, chromite, mullite and zircon and of a mass of fused zirconia has been measured up to 1,000° C. The results are exhibited in tables and in graphical form.

24. AUSTIN, W. W., JR. Behavior of Zirconium and Titanium in Steels With Particular Emphasis on the Conservation of Manganese, Part I. Blast Furnace and Steel Plant, vol. 40, No. 3, March 1952, pp. 330-334.

One approach to the problem of manganese conservation has been that of finding satisfactory substitutes for manganese in steelmaking. In this respect, the possible substitution of aluminum, molybdenum, increased silicon and phosphorus contents, titanium, and zirconium have been considered. The results of investigations on zirconium and titanium as substitutes for manganese in steels have indicated that these elements not only show good promise as substitute materials, but they also impart a number of distinctly beneficial properties to the steel. Consequently, the behavior of zirconium and titanium in steel with respect to their possibilities as manganese substitutes is being evaluated at Southern Research Institute. This paper reviews briefly the findings of previous investigations on this subject and summarizes the results to date of the current research program.

25. _____. Behavior of Zirconium and Titanium in Steels With Particular Emphasis on the Conservation of Manganese, Part II. Blast Furnace and Steel Plant, vol. 40, No. 4, April 1952, pp. 416-420.

The hot bend impact test is considered a reliable and reproducible means for quickly determining hot short temperature ranges in steels. Its correlation with rolling behavior, however, should be established experimentally in each case. Under the conditions studied, the manganese-to-sulfur ratio required to prevent hot shortness in the base steel (0.2 percent C, 0.2 percent Si, 0.03-0.04 percent S) was approximately 7.5:1. In testing very low manganese steel at high temperatures (2,300°-2,400° F.) it was difficult to distinguish between the effects of hot shortness owing to inadequate manganese content and overheating. In low-manganese steels (0.025-0.13 percent Mn) with sulfur contents between 0.025 percent and 0.06 percent, zirconium to sulfur is maintained above approximately 5.0:1. The relatively high silicon content (40-50 percent Si) of commercially available zirconium alloys results in excessive silicon contents in steels where substantial zirconium additions (0.3 percent Zr or better) must be made. In low-manganese steels (0.05-0.15 percent Mn) with sulfur content between 0.02 and 0.05 percent, titanium may be satisfactorily employed to overcome hot shortness provided the ratio of manganese plus titanium to sulfur is maintained above approximately 6.0:1. The retention of both zirconium and titanium following their additions to the base steel was appreciably better for smaller additions (0.05-0.10 percent) than for larger additions (0.3-0.5 percent).

Generated on 2024-09-20 18:03 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Titanium retention was found to be far superior to zirconium retention in the experimental heats studied to date. The average overall retention for titanium additions was 66.5 percent, whereas that for zirconium additions was 33.3 percent.

26. AUSTIN, W. W. JR. Titanium and Zirconium - Emergency Substitutes for Manganese. Steel, vol. 129, No. 19, Nov. 5, 1951, pp. 110-118.

Investigations on titanium and zirconium as replacements for manganese in steels indicate that these elements not only show good promise as substitutes but also impart some distinctly beneficial properties to fully killed steels. Among other additives, zirconium has proved successful. Comparisons have been made between titanium and zirconium. Cost-wise, titanium is slightly more than twice (2.15 times) as expensive as zirconium considering both in the form of commercial alloys. The substantially better retention and the far better outlook for domestic availability of titanium largely offset the advantage of the lower cost of zirconium.

27. AUSTRALASIAN MANUFACTURER. Heating Metals in Suspension - Float Melting in an Electromagnetic Field. Dec. 5, 1953, pp. 52-55.

In an effort to avoid the contamination incident to heating and melting reactive metals in a container, an interesting method of levitation or float melting has been developed. The metal charge is suspended in a strong electromagnetic field generated by applying high-frequency alternating current to tow coaxial oils connected in series opposition. The results obtained to date by this technique indicate that inert and reactive metals can be melted, purified, alloyed, and agitated without resort to crucibles.

28. AYERS, A. S., AND BANKS, C. V. Determination of Trace Quantities of Iron in Zirconium and Its Compounds. Ames Lab., Iowa State College, ISC-152, August 1950, 61 pp.

The literature on the determination of small amounts of iron has been surveyed. The more commonly used reagents for the colorimetric determination of iron have been discussed and references to the more important papers have been included. The applicability of the 1, 10-phenanthroline method to the estimation of the iron content of zirconium-bearing materials has been investigated using tartrate and citrate to prevent precipitation of hydrous zirconium oxides in neutral solutions. The use of tartrate has been found to permit the analysis of various zirconium materials with admirable precision in the absence of such contaminants as zinc and nickel. The sulfosalicylate method has been found to be applicable to zirconium compounds even in the presence of zinc and nickel impurities. The large blank due to iron in the sulfosalicylic acid reagent has limited the sulfosalicylate method to samples high in iron content. Recommended procedures for the analysis for iron in zirconium metal and some of its compounds have been included.

29. AYRES, C. F. Newest Light Metal Challenges Metallurgists as Technology Develops. Light Metal Age, vol. 10, No. 9 and 10, October 1952, pp. 10, 11, 20.

Gives a summary of zirconium and its possibilities.

30. AYRES, J. A. Purification of Zirconium by Ion Exchange Columns. Jour. Am. Chem. Soc., vol. 69, November 1947, pp. 2879-2881.

A method has been developed for purifying zirconium by ion exchange columns. In this procedure the zirconium is present in the colloidal form and is not adsorbed by the resin and the impurities that are present as positive ions are removed by ion exchange. This method is rapid and easily adaptable to large-scale procedures. Results of several experiments are given to show the efficiency of purification of zirconium from iron, titanium, beryllium, and lanthanum. Describes a procedure for obtaining a

Generated on 2024-09-20 18:11 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

purified solution of zirconium salt from a typical ore.

31. BADGER, A. E., AND DONEY, L. M. Glass Melts in the Systems Zirconia-Alumina-Silica and Titania-Alumina-Silica. Glass Industry, vol. 21, No. 7, July 1940, pp. 309-311.

Melts of various mixtures in the zirconia-alumina-silica and titania-alumina-silica systems were made in zircon crucibles at 1,680° C. Fragments taken from these melts were heated also in an oxy-hydrogen flame and the fusion characteristics were plotted on diagrams. An apparatus was designed to measure the thermal expansion of glass fibers. Measurements showed that the melts containing zirconia possessed low thermal expansions (about 20 x 10^{-7} per °C.), whereas titania produced glasses with somewhat greater expansion.

32. BAENZIGER, N. C., NIELSEN, J. W., AND DUWELL, E. J. Structures and Properties of Intermetallic Compounds, Progress Report, March 1, 1952 to November 30, 1952. State University of Iowa, Dec. 1, 1952, 6 pp. AECU-2279.

X-ray diffraction studies were conducted on a number of systems, including Zr-Be alloys.

33. BAGNALL, K. W., AND MILES, G. L. Simple Air Pulsed Agitator Unit. Atomic Energy Research Est., England, June 17, 1952, 2 pp. AERE C/M 151.

This report describes a simple air pulsed agitator unit, which is suitable for stirring active liquids in dry-boxes and is particularly useful for small-scale batch solvent extraction equipment.

BAHNER, C. T. See abs. 556.

BALDOCK, R. See abs. 825.

BALDWIN, W. H. See abs. 928.

34. BALL, C. J. P. Outstanding Properties of Magnesium-Zirconium Alloys. Aluminum and Magnesium, October 1946, pp. 20, 21, 41 and November 1946, pp. 12, 13, 15, 19; Metallurgia, January 1947, pp. 125-129 and February 1947, pp. 211-214.

Industries today are searching for stronger structural materials and in particular for metals of low density combined with the highest possible properties, to help, for instance, in improving the efficiencies of new turbine engines. In this paper particular attention is directed to the value of zirconium as an alloying element. Steady and persistent work has led to the production of magnesium-zirconium alloys possessing properties of an outstanding character. In addition to their exceptionally high proof stress, which, combined with high ultimate stress and elongation, may well revolutionize the ultra-light alloy casting field, their relative ease of working coupled with very high mechanical properties opens great possibilities for the wrought alloys. Data, which will be given in the concluding part, will indicate that progress of a high order has been achieved.

BANKS, C. V. See abs. 28, 98.

BANNON, R. E. See abs. 125.

BARBER, A. J. See abs. 800.

BARBOSA, P. E. See abs. 212.

35. BARLETT, H. B. X-ray and Microscopic Studies of Silicate Melts Containing ZrO_2. Jour. Am. Ceram. Soc., vol. 14, 1931, pp. 837-843.

Silicate melts containing ZrO_2 were examined by X-ray and microscope to establish the form of crystallization of the zirconium compounds under various conditions of temperature and composition. The effect of certain fluxes on these compounds was determined also.

BAROODY, E. M. See abs. 563, 564.

Generated on 2024-09-20 18:10 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

36. BARTOL RESEARCH FOUNDATION. First Annual Report of the Work of the Bartol Research Foundation of the Franklin Institute. Sept. 30, 1951, 142 pp. NP-3729.

This report deals with the results of experimental research on the topics of cosmic radiations at very high altitudes; observations of the lattice effect at high altitudes; experiments with photographic plates; redetermination of mean life of the mesotron as a function of momentum; instrumentation and some nuclear reactions relating to the Van de Graaff generator; radioactivity; thin tritium targets; double lens β-ray spectrometer; neutrons from the deuteron bombardment of phosphorus; multiple ionizing events in the Geiger counter; measurements of primary specific ionization; general observations on discharge lag in counters; and delay time G-M counters and photosensitive activation and fatigue in G-M counters and photocounters.

37. BASKERVILLE, E. E. Analysis of Beryllium-Copper. Anal. Chem. vol. 21, No. 9, September 1949, pp. 1089-1091.

A procedure for analyzing copper alloys containing small amounts of beryllium has been developed. Copper is first removed and discarded. Beryllium is generally determined first in the remaining solution, except when samples contain phosphorus or zirconium, which must be removed. Nickel and cobalt are determined on the solution resulting from beryllium removal. Special modifications are used for silicon and chromium. Silver is determined gravimetrically as the chloride.

38. BASTIAN, E. L. Wire Drawing of Some Non-Ferrous Metals. Wire and Wire Prod., vol. 24, No. 7, July 1949, pp. 588-592, 626-633. Pres. at Canadian regional meeting, Wire Association, Montreal, Canada, Apr. 28-29, 1949.

Although the subject of this paper is wire drawing, wire drawing lubricants or compounds are discussed principally as they relate to the broader subject in the nonferrous metals field.

39. BATES, J. I. Zirconium in the Operating Room. Foote Prints, vol. 22, No. 1, 1950, pp. 5-9.

Discusses uses of zirconium in the operating room.

40. BAUMRUCKER, J. E. Dissolution of Zirconium in Hydrofluoric Acid. Argonne Nat. Lab., ANL-5020, Mar. 31, 1950, 18 pp.

Tests were made on the dissolution rate in hydrofluoric acid solution of zirconium metal produced by both magnesium reduction and iodide decomposition. Metal fabricated from crystal bar dissolved at a slightly greater rate than that made from magnesium-reduced sponge. An aqueous 5 percent, by volume, solution of hydrofluoric acid was found to give the best results. However, results favorable to a desired use of this method for diffusion studies by remote control on irradiated material were not obtained.

41. BAXTER, G. P. Thirty-Third Annual Report of the Committee on Atomic Weights. Determinations Published During 1926. Jour. Am. Chem. Soc., vol. 49, No. 3, March 1927, pp. 583-590.

A critique on atomic weights.

BEACH, J. G. See abs. 775, 776, 777, 778.

BEALL, R. A. See abs. 865.

BEAUFAIT, L. J. See abs. 419.

42. BEAUMONT, R. H., JR. Spectrophotometric Determination of Titanium and Iron in Zirconium With Tiron. New Brunswick Lab., May 1951, 14 pp. NYO-2016.

Describes a method using tiron to determine traces of iron and titanium in

Generated on 2024-09-20 18:09 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

zirconium metal. Zirconium metal is dissolved in dilute hydrofluoric acid and the complex developed at a pH 4.7 by adding ammonium acetate. No precipitate of zirconium compounds is formed, and the determination can be carried out according to the general procedure of Yoe and Armstrong. The absorbency of the solution containing the blue ferric iron complex and the noninterfering titanium complex is measured at 560 mμ. The iron is then reduced to the ferrous state by adding a small amount of sodium hydrosulfite. The absorbency of the solution containing the titanium complex is measured at 410 μ. Beer's law is followed closely in both cases. Tiron, as used in this procedure, is about 10 times as sensitive as peroxide for titanium and nearly a quarter as sensitive as o-phenanthroline for iron. Of the ions that interfere, only copper has been found present and that in but a few samples. A method is discussed for removing copper, when present, by a dithizone extraction.

43. BEAUMONT, R. H., JR., AND PETRETIC, G. J. Determination of Nickel in Zirconium With Dimethylglyoxime. New Brunswick Lab., Aug. 15, 1950, 6 pp. NYO-2011.

A colorimetric method is presented for determining microgram quantities of nickel in zirconium metal with dimethylglyoxime. The zirconium metal is dissolved in dilute HF. Citric acid is added to complex the zirconium. Nickel is oxidized with bromine water. A large excess of ammonium hydroxide is added. The solution is cooled below room temperature and dimethylglyoxime is added. After approximately 15 minutes, the optical density of the solution is measured at 540 mu. Interferences are negligible. Results are given and are shown to be comparable to those obtained polarographically. The color is stable for at least 3 hours, but results are better if the optical density is measured after a definite length of time.

44. BECK, C. B., CANBY, T. D., AND ZONIS, I. S. Fluidized Condenser. Massachusetts Inst. Technol., 1952, 79 pp. KT-123.

An apparatus using a fluidized bed of cold recycled zirconium-tetrachloride powder to condense a stream of hot zirconium-tetrachloride vapor was designed and constructed. The operation of the fluidized condenser was successfully demonstrated. It was shown that caking of zirconium tetrachloride on the walls of the column was slight, with the greatest part of the condensation occurring in the fluidized phase. Because of time limitations, few runs were made.

45. BECK, P. A., AND MERLINI, A. Progress Report No. 1 on Annealing of Cold Worked Metals. Univ. Illinois, Oct. 1, 1952, 13 pp. AECU-2281.

Improved integrating specimen holders were designed and built for the quantitative determination of preferred orientation by means of the reflection and the transmission methods. Specimen and slit alignment procedures were developed for use with both methods to improve the accuracy. (111) and (200) pole figures were determined for cross rolled copper. These show two major texture components of the type (110) /$\bar{2}$23/ and of a minor texture component consisting of spreads around the cube texture.

BECKER, R. A. See abs. 811.

46. BEELEY, P. R., AND PROTHEROE, H. T. Adherence of Sand on Steel Castings. Jour. Iron and Steel Inst., vol. 167, No. 2, February 1951, pp. 141-157.

The first part of the paper details methods employed for visual comparison of the degree of roughness on steel castings and for a numerical assessment of penetration. A relationship between metal penetration and sand adherence has been established. The temperature limit at which adherence occurs, in the case of the standard casting adopted, has been determined for casting temperature, metal composition, and sand conditions. The conditions at the sand/metal interface are considered in relation to

Generated on 2024-09-20 18:10 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

adherence, and the mechanism of adherence is explained. The product of the reaction between the metal and sand is the iron silicate $2FeO.SiO_2$. A second section deals with the effect of varying the bond of the sand. The relative merits of various mould paints have been determined; Corefrax sillimanite, fused alumina, zircon, and plumbago are compared with silica flour. The effect of changing the bond in any paint has also been investigated. Includes an examination of some industrial samples exhibiting severe burning-on.

BEKEBREDE, W. R. See abs. 900.

BEKEBREDE, W. R., AND YNTEMA, L. F. Less Common Metals. See abs. 901.

BEINLICH, A. W., JR. See abs. 695.

BELL, J. M. See abs. 916.

47. BELOZERSKIY, N. A., AND KUCHERENKO, O. A. /Phase Diagrams of the $ZrCl_4$ - NaCl and ZrO_2 - $CaCl_2$ Systems and Directions for Preparing Pure Salts $ZrCl_4$ and $TiCl_5$./ Jour. Appl. Chem. (U. S. S. R.), vol. 13, No. 11, November 1940, pp. 1545-1555. NP-2251.

During electrolysis of molten sodium chloride, to which zirconium chloride has been added, pure powdered zirconium is deposited at the cathode. The volatility of zirconium chloride makes the choice of a suitable electrolyte for the chloride bath difficult. The total volatility of a binary system of salts is determined by the volatility of the more easily evaporated component, as long as Raoult's law applies. This will not be the case whenever complex compounds form, and the present work was carried out in order to investigate that possibility.

48. BELSER, R. B. Frictional Adhesion of Metal to Glass, Quartz and Ceramic Surfaces. Rev. Sci. Instruments, vol. 25, No. 9, September 1954, 3 pp.

In 1947 W. A. Wooster and G. L. McDonald reported that titanium would adhere by frictional contact to glass and certain mineral and ceramic surfaces. In order to explore this property further small disks of a number of different metals, mounted separately on one-eighth-inch shafts driven by a high-speed hand-grinder, were applied to glass, quartz, and ceramic surfaces. By suitably varying the r.p.m. of the motor and the pressure of application, the metal of the disks could be made to adhere securely to such surfaces. At higher r.p.m. the glass surfaces usually eroded. Variations of the technique of application allowed either the metallic coating or the cutting of glass. Some of the metals tested were titanium, zirconium, aluminum, magnesium, gold, silver, copper, iron, nickel, cobalt, cadmium, zinc, and lead. It was found that zirconium adhered to glass when rubbed on a clean glass surface by hand.

49. _____. New Methods for Decorative Application of Metal to Glass and Ceramic Surfaces. Ceram. Age, vol. 62, No. 4, October 1953, pp. 17, 18, 20, 21, 29, 30.

This paper presents two procedures for applying metal to glass for decorative or utilitarian purposes. The first is the application of molten indium to a clean glass ceramic or hard mineral surface with a small heated tool. The second is the application of almost any metal to similar surfaces by spinning the metal at high r.p.m. as part of a rotating shaft in contact with the desired surface.

BELZ, L. H. See abs. 13.

BENDEL, W. L. See abs. 811.

BENEDICT, J. T. See abs. 475, 476.

50. BENNETT, D. G. Ball Milling Studies of Five Pure Oxides, Report No. 34. University of Illinois, Mar. 3, 1949, 15 pp. NP-1121.

Present data is given on the effects of ball milling five pure oxides and upon

Generated on 2024-09-20 18:04 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

particle size measurements of each of them.

51. BENNETT, D. G. Suppression of Radiations at High Temperatures by Means of Ceramic Coatings. Jour. Am. Ceram. Soc., vol. 30, No. 10, Oct. 1, 1947, pp. 297-305.

A method was developed for measuring the emissivities of ceramic coatings and ceramic-coating materials with respect to oxidized stainless steel. The emissivities in the visible-red and near-infrared spectral regions were studied over a temperature range of 800° to 1,600° F. The numerous materials investigated were found to cover an emissivity range from more than 100 percent to less than 10 percent. Lepidolite was the highest emitter, uverite the lowest. Transmission of radiant energy decreased with coat thickness according to established laws. The transmission of radiant energy through coat-bonding glasses could be greatly influenced by composition. Every material has a characteristic tendency to emit radiations at a given temperature. High-temperature ceramic paints were found to be effective radiation suppressors and thermal insulators.

See also abs. 610.

BERG, M. See abs. 484, 485.

BERGER, M. J. See abs. 334, 335, 336, 337, 791.

52. BERGER, M. J., LUBKER, R. A., AND JOHNSON, G. W. Casting of Titanium and Titanium Base Alloys, Rept. 5. Armour Res. Found., Apr. 29, 1952, 17 pp. U-22340.

The objective of this project is to develop titanium and titanium-alloy castings for production. This report deals chiefly with the information obtained on titanium and titanium-alloy castings produced in sand molds and sand molds coated with a graphite wash. A number of heats are discussed and results and descriptions are included.

BERGLUND, F. See abs. 403.

53. BERNARDINI, G. F. Injection Molding of L-5 Ceramics, Ninth Quarterly Report. Stupakoff Ceram. Mfg. Co., July 15 to Oct. 15, 1948, 25 pp.

A series of investigations was made to develop a ceramic material and a process for injection molding, a suitable glazing material, and multicavity dies for mass production of injection molded parts. Efforts were made toward improving the mixing and firing method. The procedures of injection molding, preparation of material, and baking and firing are outlined. The effect of slow baking, base material types and variability of injection results are discussed. The best results were realized with materials 7472 and 7102. The latter material contains a zircon porcelain base and presents an added field for investigation. A comparison was made among steatite, zircon, and alumina base bodies. It was concluded that continued efforts must be directed toward obtaining maximum plasticity with minimum binder content.

BERNSTEIN, H. See abs. 758.

54. BERNSTEIN, R. B., AND CUBICCIOTTI, D. Hydrogen Permeability of Zirconium, Technical Report No. 3, Reactions of Metals with Gases at High Temperatures. Illinois Inst. Technol., November 1949, 15 pp.

The rate of permeation of hydrogen through ductile zirconium sheet was measured over the temperature range 400°-900° C. The permeability was found to decrease approximately exponentially with a half-time of about 1.5 hours. An apparent energy of activation for the process of permeation was estimated. The flow rate was found to be proportional to the square root of the hydrogen pressure.

BEYER, G. H. See abs. 447

55. BIRCH, R. E. Refractories of the Future. Eng. Expt. Sta. News, vol. 17, No. 4, October 1945, pp. 3-7.

Generated on 2024-09-20 18:03 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

A survey of the refractories industry today includes technical data of many refractory materials in use or in experimental stage.

56. BLEIL, H. E., AND VARGA, J., JR. Influence of Zirconium on Malleablization of White Cast Iron. Foundry, vol. 78, No. 10, October 1950, pp. 94-99.

In studying effects of zirconium on malleablization of white cast iron, the authors employed heats containing zirconium in amounts ranging from 0.054 to 0.329 percent. Their investigations showed that the time necessary for complete solution of cementite at the upper critical was greater with increased amounts of zirconium. Specimens examined for second stage annealing effects were normal with respect to completion.

BLEVITZKY, R. See abs. 141.

57. BLUMENTHAL, W. B. Precipitation of Basic Dyes With Modified Hydrous Zirconia. Am. Dyestuff Reporter, vol. 37, May 3, 1948, pp. 285-286.

Hydrous zirconia is treated with various anions that combine with it to form electronegatively charged zirconeate micelles. These micelles are found to precipitate basic dyes, forming insoluble complex substances. On properly preparing these precipitates, new pigments of useful properties are obtained.

58. _____. Zirconium Compounds in Water-Repellents for Fabrics. Ind. Eng. Chem., vol. 42, January-December 1950, pp. 1381-1383.

The development of water-repellent treatments for fabrics, based on the use of zirconium salts, is reviewed briefly, and some limitations of the salts are noted. Experimental work is reported in which it is shown that zirconium salts used alone render textiles somewhat water repellent, and when used in conjunction with soaps and wax emulsion, a very high quality of water-repellence results. Water repellence so imparted is generally lost by laundering or dry cleaning the fabric, but may be stabilized to some extent by treatment with an additional solution of a metal salt having a strongly acid hydrolysis. A mechanism for the repellence of water by the treated fabric is propounded.

59. _____. Zirconyl and Basic Zirconyl Compounds in Acid Dyestuffs. Ind. Eng. Chem., vol. 40, No. 3, March 1948, pp. 510-512.

Zirconyl and basic zirconyl salts are found to be precipitants for many acid dyestuffs and it is believed that they will precipitate the entire class of acid dyestuffs. The compounds which form are salts of the cations ZrO^{++}, $Zr_2O_3^{++}$, and $Zr_5O_9^{++}$ with the dye anions. Techniques are described for forming these compounds under such conditions that they fulfill the requirements of pigment toners of good quality.

BOEDEKER, E. R. See abs. 615.

BOLTZ, D. F. See abs. 479.

60. BOODY, F. P. Density of Hafnium and Zirconium Metals. Carbide and Carbon Chem. Corp., Nov. 16, 1950, 8 pp. Y-696.

This report covers work done on measurements of the densities of hafnium and zirconium metals. The hafnium metal used was better than 98 percent pure and the zirconium metal better than 99 percent pure.

BOOTH, E. T. See abs. 312, 313.

61. BOULGER, F. W. Properties of Zirconium. Battelle Mem. Inst., Mar. 15, 1949, 83 pp. AECD-2726.

Gives a critical review of the information (published up to February 1949) on zirconium with estimates of the uncertainty in the values. Limitations of the available data result principally from the fact that zirconium is produced in small batches on a pilot-plant scale,

Generated on 2024-09-20 18:03 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

so that the purity of different lots may vary significantly. Unfortunately, certain analytical techniques are inadequate and others are used too infrequently to identify the composition of materials tested by many investigators.

See also abs. 824.

62. BOUNDS, A. M., AND COOPER, H. W. Annealing of Ti and Zr. Metal Progress, vol. 59, January 1951, pp. 69, 100, 102.

The effect of annealing these reactive metals in active gas (air or controlled atmosphere) is not only to seal the part as expected but also to produce a surface hardening of the metal, which cannot be eliminated by descaling or pickling. Inert atmosphere protects against such effects but is quite expensive, particularly for large parts or long, thin parts (wire or tube). Vacuum annealing appears to be best practice for light parts, from the standpoints of both quality and economy. Pickling of heavily scaled objects is very difficult, and the most practical method so far devised is descaling in molten caustic. Unfortunately the caustic treatment entails some dangers which have not yet been thoroughly studied.

63. _____. Fabrication of Titanium and Zirconium. Metal Progress, vol. 58, No. 2, August 1950, pp. 185-188.

This paper covers all the pertinent details of fabrication procedure on titanium and zirconium.

64. BOWEN, H. G., JR., AND BERNSTEIN, H. Effect of Sixteen Alloying Elements Upon the Grain Size of Cast 4.5 Percent Copper-Aluminum Alloy. Trans. Am. Soc. Metals, vol. 40, 1948, pp. 209-222.

Experimental ingots of 4.5 percent copper-aluminum alloy containing percentages of the elements under consideration, varying from 0 to 1.4 percent, were cast at 1,350° F. (730° C.) under conditions calculated to produce a coarse grain size. The elements were added mainly as aluminum master alloys. After suitable preparation, the ingots were etched and their grain sizes measured. The refining effects of titanium, columbium, and zirconium, separately, were tested upon superheated melts at 1,750° F. (955° C.). The effects of various combinations of elements and the effect of heat treatment upon given size were determined. The grain-refining agents were found to be particularly effective in counteracting the coarsening effects of other alloys. Radiographic examination indicated that the dendritic characteristics of the base alloy were markedly altered by refining agents.

65. BOWERMAN, E. W., AND FERNELIUS, W. C. Reactions of Zirconium Tetrabromide in Liquid Ammonia. Jour. Am. Chem. Soc., vol. 61, January 1939, pp. 121-124.

The following ammonolytic equilibrium exists in liquid ammonia:

$$3ZrBr_4.xNH_3(sol.) + yNH_3 \rightleftharpoons 3Zr(NH)_2.7NH_4Br.zNH_3(insol.) + 5NH_4Br.$$

Conditions which bring the point of equilibrium to the left are (1) low temperature, (2) concentrated solutions, and (3) high concentration of ammonium bromide. At 0° or above, without addition of ammonium bromide, the point of equilibrium lies almost quantitatively to the right. It appears that a second ammonolytic equilibrium exists $3Zr(NH)_2.7NH_4Br.zNH_3 + mNH_3 \rightleftharpoons 3Zr(NH)_2.nNH_3 + 7NH_4Br$. The reaction toward the right is brought about by reagents that remove the ammonium bromide (potassium and potassium amide). The resultant zirconium imide is always contaminated with some potassium ammonozirconate. Addition to ammonobasic zirconium bromide of potassium amide in excess of the amount equivalent to that of the bromine, results in the formation of potassium ammonozirconate $Zr(NH)_2.nNH_3 + 2KNH_2 \rightleftharpoons Zr(NK)_2.sNH_3 + +NH_3$. This salt is extensively ammonolyzed at 0°. Potassium ammonozirconate reacts with ammonium bromide to form ammonobasic zirconium bromide.

Generated on 2024-09-20 18:05 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

66. BOYD, G. E., AND HARKINS, W. D. Energy of Immersion of Crystalline Powders in Water and Organic Liquids. Jour. Am. Chem. Soc., vol. 64, May 1942, pp. 1190-1204.

This is a discussion of determinations of the heats of immersion of certain crystalline solids in water and organic liquids. In this work, the areas were determined, more liquids and solids were investigated by colorimetric methods. Described the experiments in detail and the apparatus.

67. BRADLEY, D. C., HALIM, F. M., MEHROTA, R. C., AND WARDLAW, W. Action of Alcohols on Zirconium Tetrachloride and Zirconium Chloride Alkoxides. Jour. Chem. Soc., December 1952, pp. 4960-4963.

The reactions of zirconium tetrachloride and of zirconium chloride alkoxides with various alcohols have been examined. From the tetrachloride and methanol the equimolecular mixture of $ZrCl_3(OMe)$, MeOH, and $ZrCl_2(OMe)_2$ was obtained. Alcohol interchange occurs between zirconium dichloride dialkoxides or zirconium chloride trialkoxides and primary or secondary alcohols and is a convenient means for preparing zirconium chloride alkoxides. The new compounds $ZrCl(OMe)_3$ and $ZrCl_2(OMe)_2$ were thus prepared. With tertiary alcohols and $ZrCl(OPr^i)_3$, Pr^iOH the alcohol interchange was accompanied by a second reaction, which formed alkylhalide, olefin, and water, but the new chloride tri-tert.-amyloxide of zirconium could be prepared by a modified procedure. The nature of the second reaction was investigated and a mechanism is proposed.

68. _____. Reactions of Acetyl Chloride With Zirconium Alkoxides. Jour. Chem. Soc., vol. 74, December 1952, pp. 4609-4612.

Reactions of primary, secondary, and tertiary alkoxides of zirconium with acetyl chloride have been investigated and the following new compounds prepared: $ZrCl_4$, Pr^nOAc; $ZrCl_4$, $2Pr^iOAc$; $ZrCl_2(OPr^i)_2$, Pr^iOH; $ZrCl(OPr^i)_3$, Pr^iOH; and $ZrCl(OPr^i)_3$. No hydrogen chloride was evolved in reactions involving $Zr(OPr^i)_4$, Pr^iOH, and acetyl chloride even in the presence of excess of isopropyl alcohol, and $ZrCl_3(OPr^i)$, $2Pr^iOH$ was obtained by treating $Zr(OPr^i)_4$, Pr^iOH with hydrogen chloride. Radical interchange reactions involving chloride alkoxides of zirconium are demonstrated and mechanisms of radical interchange between chlorides and alkoxides of silicon, titanium, and zirconium are discussed.

69. BRADLEY, D. C., HALIM, F. M., SADEK, E. A., AND WARDLAW, W. Preparation of Zirconium Alkoxides. Jour. Chem. Soc., vol. 74, June 1952, pp. 2032-2035.

The preparation of $(C_5H_6N)_2ArCl_6$ (C_5H_6N-pydridinium from zirconyl chloride or zirconium ium tetrachloride is described. The zirconium alkoxides $Zr(OR)_4$, where E - Et, Pr^i, Bu^s and Bu^n, were prepared by treatment of $(C_5H_6N)_2ZrCl_6$ and the alcohol (ROH) with ammonia in benzene. The complex zirconium chloride reacted with tert.-butyl alcohol and ammonia in pyridine and gave $ZrCl(OBu^t)_3$ which disproportionated when heated, to give zirconium tetra-tert.-butoxide. $(C_5H_6N)_2Zr(OEt)Cl_5$ was obtained from the reaction between sodium ethoxide and $(C_5H_6N)_2ZrCl_6$.

70. BRADLEY, D. C., MEHROTRA, R. C., AND WARDLAW, W. Structural Chemistry of the Alkoxides. Part II. Tertiary Alkoxides of Silicon, Titanium, Zirconium, and Hafnium. Jour. Chem. Soc., vol. 74, November 1952, pp. 4204-4209.

The tertiary alkoxides $M(O.CM_nEt_{3-n})_4$, $M(O.CM_2R)_4$ and $M(O.CMeEtPr^i)_4$, where M - Ti or Zr; n - 0, 1, 2 or 3; and R - Me, Et, Pr^n, Pr^i or Bu^t, have been prepared. Ebullioscopic measurements show that these compounds are monomeric. Vapor pressure measurements on the lower tertiary alkoxides show that boiling points and latent heats increase with molecular

Generated on 2024-09-20 18:03 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

size but entropies of vaporisation show little variation. A comparison of isomeric tertiary alkoxides reveals the effect of chain branching on volatility. Most titanium tertiary alkoxides are less volatile than their zirconium analogues, whereas hafnium tert.-amyloxides is more volatile than the zirconium derivate. Therefore, the surprising order of volatilities, Hf > Zr > Ti, is found for the tert.-amyloxides. The position of silicon in this series is discussed.

BRADSHAW, G. See abs. 576.

71. BRADT, W. E., AND LINFORD, H. B. Electrolysis of Aqueous Solutions of Sodium and Zirconyl Sulfates. Trans. Electrochem. Soc., vol. 70, 1936, pp. 431-439.

Aqueous solutions of sodium and zirconyl sulfates were electrolyzed under controlled conditions. Difficulties due to the hydrolysis of zirconyl sulfate were partly avoided by adding Na_2SO_4. Factors investigated were: Concentration of zirconyl sulfate, concentration of sodium sulfate, hydrogen ion concentration, current density and temperature of electrolyte. Electrodeposited metallic zirconium was obtained in two forms. One is a silver-white, compact, adherent metal similar to nickel electroplate in appearance. This slowly changes to the other modification, which appears to be a nonadherent aggregation composed of a black powder, which may be zirconium or some oxidation product of zirconium. Conditions are described for obtaining thin deposits of compact bright metal.

72. BRADY, E. L. Note on Comparison of Phosphate and Oxalate Methods for Determination of Zirconium Activity in Fission; chap. in Radiochem. Studies: The Fission Products, Nat. Nuclear Energy Series. McGraw-Hill Book Co., Inc., New York, N. Y., book 3, vol. 9, No. 6, 1951, p. 1498.

From measurements of the fission yield of 65d Zr^{95} it is found that the oxalate method gives higher and more reproducible results than does the phosphate method.

73. BRADY, E. L., ENGELKEMEIR, D. W., AND STEINBERG, E. P. Characteristics of 65d Zirconium by Chemical Study; chap. in Radiochem. Studies: The Fission Products, Nat. Nuclear Energy Series. McGraw-Hill Book Co., Inc., New York, N. Y., book 2, vol. 9, No. 5, 1951, pp. 711-716.

The long-lived zirconium activity in fission has a half-life of a 65 ± 2 days. The β spectron is complex, a group of 98 percent having an energy of 0.4 Mev and a group of 2 percent having an energy of 1.0 Mev. The γ energy is 0.88 Mev. The species is identical with the 63d ± 5d Zr produced by the Mo(n, α) and Zr (d,p) reactions. From consideration of the fission yield based on three different isloation procedures, a value of about 6 percent is established.

BRAY, W. C. See abs. 662.

74. BREDEN, C. R., GREENBERG, S., ROBINSON, R. M., ROEBUCK, A. H., SAITTA, V. F., AND SCOTT, C. C. Water Corrosion of Structural Materials, Report 1, October 1948 - June 1951. Argonne Nat. Lab., ANL-4519, July 15, 1951, 197 pp.

A program of evaluating the corrosion resistance of materials considered for use in high-temperature water systems has been undertaken. Results on structural materials are presented. The tests were carried out, for the most part, in high-pressure autoclaves. Of the materials tested, the austenitic stainless steels plus the precipitation-hardening stainless steels and high-cobalt alloys were found to be the most satisfactory in 500° F., oxygenated water.

BRENNAN, W. E. See abs. 252.

Generated on 2024-09-20 18:03 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

BREWER, L. See abs. 187, 580.

75. BREWER, L., SAWYER, D. L., TEMPLETON, D. H., AND DAUBEN, C. H. Study of the Refractory Borides. Jour. Am. Ceram. Soc., vol. 34, No. 6, June 1951, pp. 173-179.

The phases of binary systems of boron with Ce, Ti, Zr, Nb, Ta, Mo, W, Th, and U were determined by X-ray examination of samples prepared by heating various mixtures of boron and the respective metal to elevated temperatures in an atmosphere of argon. Data were obtained on the sintering behavior and stability at high temperatures of many of the phases. Several phases have promising refractory properties for use under inert or reducing conditions.

76. BREWER, L., AND WEST, G. H. Construction and Testing of Surface-Combustion Furnaces. Argonne Nat. Lab., June 20, 1949, 5 pp. MDDC-550.

Two surface-combustion furnaces have been constructed and have been used up to 2,000° C. Both MgO and ZrO_2 have been found to be satisfactory construction materials. Propane was used for fuel.

77. BRICK, R. M., LEE, H. T., AND GREENEWALS, H. Preparation of Single Crystals of Beryllium and Zirconium: Study of Mechanical Properties. University of Pennsylvania, July 1 - September 1950, 5 pp. NP-1836.

Fifteen single crystal specimens of beryllium have been prepared, and tests of these under compression are underway. Compressed normal to the basal plane at room temperature, no plastic behavior was observed and deformation was apparently solely elastic up to a stress of about 285,000 p.s.i., at which point fracture occurred. Compressed parallel to the basal plane (1072) twinning was observed and a critical stress calculated. Some zirconium that is substantially free of a second phase in certain areas, at least, has been obtained and is being annealed for single crystal production. Simultaneously, work is proceeding on the hardness, microstructure, and precision lattice parameter changes of zirconium with addition of oxygen and nitrogen.

78. BRIDGMAN, P. W. Compression of 39 Substances to 100,000 Kg./Cm.^{2} Proc. Am. Acad. Arts Sci., vol. 76, 1948, pp. 71-78.

In this paper, the program of measurement of the compressions of various substances to 100,000 kg./cm.^{2} already initiated in 2 papers is continued to 39 substances, including elements, various sulfides, selenides, and tellurides, and 6 glasses. A number of improvements have been made in the apparatus, permitting somewhat greater accuracy and consequently the extension of the measurements to substances with too low a compressibility to have been previously attempted.

79. _____. Effects of High Shearing Stress Combined With High Hydrostatic Pressure. Phys. Rev., vol. 48, Nov. 15, 1935, pp. 825-847.

Mean hydrostatic pressures up to 50,000 kg./cm.^{2} combined with shearing stresses up to the plastic flow point are produced in thin disks confined between hardened steel parts so mounted that they may be subjected to normal pressure and torque simultaneously. Qualitative and quantitative studies are made of the effects of such stresses. Among the qualitative effects, it is found that many substances normally stable become unstable and may detonate, and conversely combinations of substances normally inert to each other may be made to combine explosively. Quantitatively, the shearing stress at the plastic flow may rise to the order of 10 or more times greater at 50,000 kg./cm.^{2} than it is normally at atmospheric pressure; this is contrary to the usually accepted results in a narrower range of pressure. If the substance undergoes a polymorphic transition under these conditions of stress, there may be a break in the curve of shearing stress vs. pressure. This gives a very convenient tool for detecting transitions.

Generated on 2024-09-20 18:08 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Fifty-seven elements have been explored in this way and a number of new polymorphic transitions found.

BROIDA, A. See abs. 889.

BROMLEY, L. A. See abs. 187, 580.

BROUGHTON, D. B. Less Common Metals. See abs. 899.

See also abs. 898.

80. BROWN, J. Use of Cupferron (Phenylnitrosohydroxylamine Ammonium) in: I. The Quantitative Separation of Zirconium, Titanium, Iron, Manganese and Aluminum. II. Analysis of Zircon and Baddeleyite. Jour. Am. Chem. Soc., vol. 39, July 1917, pp. 2358-2366.

Results show that the cupferron reagent may be used in acid solution for the quantitative precipitation of iron, titanium, and zirconium from solutions containing these elements mixed with aluminum and manganese. The first three of these elements may be separated by standard methods as by the procedures outlined in this report. The aluminum and manganese may be determined by standard methods after removing excess cupferron. Analyses were made both of mixed solutions of pure salts and of minerals with accurate results.

81. BROWN, J., AND MADDEN, H. T. Separation of Zirconium and Titanium as the Phosphates. Jour. Am. Chem. Soc., vol. 42, 1920, pp. 36-39.

The separation of titanium and zirconium by the Hillebrand method is quantitative within the limits used in this work. The zirconium phosphate is converted to the dioxide and gives accurate results. The titanium in the filtrate from the zirconium phosphate may be completely precipitated by using sodium or ammonium phosphate, but as this precipitate is of variable composition, it should be converted to the dioxide to obtain quantitative results.

BROWN, L. J. See abs. 621.

BROWN, W. E. See abs. 417.

82. BROWN, W. E., AND RIEMAN, W. Separation of Titanium, Zirconium, and Thorium by Ion Exchange. Jour. Am. Chem. Soc., vol. 74, No. 5, Mar. 5, 1952, pp. 1278-1282.

A method has been developed for the quantitative separation of titanium, zirconium and thorium by ion-exchange technique. The nature of the complexes between metal and citrate ions has been investigated and some probable complexes given. Radiochemical work with titanium-51 showed that the radioactive isotope was, to a certain extent, separated from the normal isotopes. It is believed that partial separation of the natural isotopes of titanium was achieved and that this separation accounts for the unusual shape of the elution curve of this element.

83. BRUMBAUGH, R. J. Corrosion Resistance of Zirconium. Ind. Eng. Chem., vol. 43, No. 12, December 1951, pp. 2878-2880.

Until recently all zirconium metal contained from 2 to 3 percent hafnium as impurity. Now commercial amounts of the metal are being produced that contain less than 0.1 percent hafnium. In previous reports on corrosion resistance of zirconium metal, investigators made no determinations of oxygen, nitrogen, or carbon content of metal being tested. This paper reports results of investigation of effects of small amounts of oxygen, nitrogen, carbon, and hafnium on corrosion resistance of zirconium metal. Higher concentrations of these contaminants were not studied as they would not ordinarily occur in commercial metal of this grade. Presence of any of these impurities lowers corrosion resistance of zirconium. Essentially pure zirconium metal has been found to be extremely resistant to attack by fuming nitric acid.

Generated on 2024-09-20 18:05 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

84. BRUNSTETTER, D. R., AND ALEXANDER, B. H. Creep of Zirconium. Sylvania Elec. Prod., Inc., June 9, 1949, 17 pp. AECD-3008.

This report is on evaluation of the creep characteristics of zirconium at various temperatures. Tests at room temperature (25° C.) and at 200° C. have been completed, the tests having been conducted in air. The data obtained from these tests form the basis of this report. Future tests will be conducted in an atmosphere of water at the desired testing temperature.

85. BUNN, E. S. Wrought Magnesium - Alloys, Properties, Fabrication and Uses. Metal Progress, vol. 48, October 1945, pp. 708-712.

Discusses the alloying elements, principal alloys, fabrication, physical properties, and design characteristics of wrought magnesium.

BURBRIDGE, T. N. See abs. 493.

BURDICK, M. D. See abs. 518.

86. BURDICK, M. D., MORELAND, R. E., AND GELLER, R. F. Strength and Creep Characteristics of Ceramic Bodies at Elevated-Temperatures Nat. Advisory Comm. Aeronau. NACA TN-1561, April 1949, 55 pp.

One hundred nine tests have been made to evaluate certain characteristics of six ceramic oxide bodies for high-temperature applications, especially as turbine blades. Primary emphasis was placed on determinations of strength and resistance to creep under tensile stress at elevated temperatures. Additional data for these bodies on bulk density, linear thermal expansion, modulus of elasticity, and effect of water vapor on strength are given.

87. BUREAU OF MINES. Colorimetric Determination of Aluminum in Zirconium. Albany, Oreg., undated, 4 pp.

The chemical method for determining small amounts of aluminum in zirconium employs a cupferron precipitation for the separation of zirconium followed by the colorimetric estimation of aluminum with aluminon. The details of the method were determined by critical study of the individual steps and represent a workable compromise of several major difficulties.

88. BURGERS, W. G. Crystal Structure of β-Zirconium, Nature, vol. 129, No. 3251, Feb. 20, 1932, p. 281.

Work has been done on the crystal structure of β-zirconium at Natuurkundig Laboratorium der N. V. Philips' Gloeilampenfabrieken, Eindhoven, Holland. The crystal structure of the high temperature (β-zirconium) has been determined to be cubic body-centered with two atoms of the metal in an elementary cube, the side-length of which at a temperature in the neighborhood of the transition point is 3.61 A.

See also abs. 908.

89. BURGERS, W. G., FAST, J. D., AND JACOBS, F. M. /Drawing and Recrystallization Wire./ Ztschr. Metallkunde, vol. 29, 1937, pp. 410-412.

Zirconium wire cold drawn without any heating, by hammering and drawing a zirconium rod coated with iron, has a drawing texture that differs from that in the 'normal' wire by having not only a plane of the base (0001) but also a diagonal axis of the 11 kind /10$\bar{1}$0/ parallel to the axis of the wire (with a certain scattering). During recyrstallization, a recrystallization texture is developed that is different from the drawing texture; although the position of the base remains unaltered, there is a diagonal axis of the 1 kind /11$\bar{2}$0/ parallel to the axis of the wire. This texture is retained after heating above the transformation point and subsequent cooling to room temperature.

90. BURGERS, W. G., AND van AMSTEL, J. J. Electron-Optical Observation of the Transition of α-Into β-Zirconium.

Generated on 2024-09-20 18:03 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Nature, vol. 141, Feb. 19, 1938, p. 330.

An abstract of an article concerning the investigation of the transformation process of the hexagonal α-into the cubic β-modification of Zr by X-rays.

91. BURGESS, L. Separation of Aluminum, Beryllium, and Zirconium From Their Ores. Trans. Am. Electrochem. Soc., vol. 47, 1925, pp. 317-325.

The ores containing these elements are reduced with carbon in the electric furnace. The product of reduction is contracted with dry gaseous HCl, preferably at a low red heat. The corresponding anhydrous chlorides are formed, which volatilize and may be condensed in a substantially pure condition. The respective oxides may be obtained by solution in H_2O and evaporation, which produces complete hydrolysis.

BURGUS, W. H. See abs. 249.

BURKHART, C. A. See abs. 841.

BURNETT, H. C. See abs. 773.

BUSBY, T. S. See abs. 676.

BUSCH, L. S. See abs. 520.

92. BUSH, O. B., VANDERGRIFT, R. B., AND HANLEY, T. E. Use of Titanium and Zirconium Nitrides as a Conducting Element in Thoria Cathodes. Jour. Appl. Phys., vol. 20, December 1948, pp. 295-296.

At the Naval Research Laboratory a study has been made of directly heated thoria cathodes, and in the course of the investigation it has been found that addition of the nitrides of titanium and zirconium will form conducting cathodes that can be directly heated.

BUTLER, T. A. See abs. 848.

93. CAHOON, H. P., AND JOHNSON, P. D. Effects of Chemical Additions on the Hydration Rate of Fired Quicklime (CaO). Jour. Am. Ceram. Soc., vol. 34, No. 8, August 1951, pp. 230-235.

The effects of various oxide additions to specially prepared lime briquets fired to 1,625° and 1,750° C. for 1- and 4-hour periods are described as rates of hydration of the final product. The tests indicated that Fe_2O_3 was most effective in reducing the hydration rate. The method of incorporating the additive also controlled this rate. The studies included 1 percent increments up to a total of 5 percent of the following materials: Fe_2O_3, Cr_2O_3, V_2O_3, MnO_2, CoO, TiO_2, NiO, and $Ca(PO_3)_2$. Other oxides used without any noticeable effects were MgO, ZnO, ThO_2 ZrO_2, and SnO_2.

94. CALDERWOOD, W. Production of Ceramic Ware by Slip-Casting. Iowa State College, Oct. 20, 1945, 8 pp. AECD-2736.

The best previous summary of work on slip-casting in the literature is a paper by Thompson and Mallett. Ceramic bodies of many sizes and shapes and of varying chemical and refractory properties were required for the study of physical properties of metals and alloys, for thermal analysis of alloys, and for casting metals. Zirconia, beryllia, thoria, and alumina were successfully fabricated in this way. Describes preparation of the slip, casting of the body, removal of the cast from the mold, firing of the body, and properties of the resultant ware. The formation of special shapes, such as thermocouple shields and other bodies, is described. Describes the uses of cotton cord as a form that is burned out on firing to produce ware with holes or perforations. In the high-temperature melting of metals, in the thermal studies of composition, in the properties of metals and alloys, a great many crucibles, shields, and other ceramic bodies of variety of properties are needed. Several different modes of fabrication have been used, including slip-casting. Materials such as CaO are not adoptable to the slip-casting methods because of their chemical reactivity. Other oxides are sufficiently unreactive

Generated on 2024-09-20 18:09 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

with water to permit the formation of slip, in which case the method produces good, sound ware with a small amount of equipment.

CAMERON, A. E. See abs. 941.

CANBY, T. D. See abs. 44.

95. CARBIDE AND CARBON CHEM. CORP. Physics Division Quarterly Progress Report for Period Ending March 15, 1950. June 13, 1950, 75 pp. ORNL-694.

This report covers scintillation spectrometer, beta spectrum of K^{40}, Rb^{87}, resolving power of the scintillation spectrometer; electron energy studies with the anthracene scintillation spectrometer; spectrum of 2.5-sec erbium isomer; single-channel differential pulse height selector; a multichannel pulse sorter; the total cross section of holmium; ferromagnetic scattering by cobalt; coherent scattering cross sections, nickel, calcium; radioactive decay of the neutron; alignment of nuclei; investigation of nuclear effects in paramagnetic salts; experiments below 1 ° K - measurements of some superconductors, yttrium, zirconium, gallium, cadmium, and thorium; fast neutron bombardment effects in germanium; transmutation-produced germanium semiconductors; preparation of intrinsic semiconductors; rectifier experiments; new physics of solids 'hot' laboratory; cryostat for pile irradiations, electron bombardment of Be-Cu; X-ray diffraction spectrometer for highly radioactive specimens; low-temperature X-ray diffraction; growing single crystals of iron-silicon alloy.

96. _____. Physics Division Quarterly Progress Report for Period Ending June 20, 1952. Jan. 9, 1953, 27 pp. ORNL-1365.

This report covers total neutron cross sections of N^{14}, Ge, Se, Cd, and Hg; energy spectra of particles from the reactions $He^3(Li^6, Li^5)$ He^4 and $He^3(Li^6, Be^8)$ H^1; absorption of gamma rays; lifetime of an excited state of Hf^{176}; gamma-gamma angular correlation in Ta^{181}; angular correlation of gamma rays; short-period activities; electrical resistance of high-purity zirconium below 300° K; paramagnetism of trivalent uranium; average energy per ion pair; neutron cross section measurements for polycrystalline nickel and nickel oxide in the thermal energy region; crystal diodes; neutron-sensitive scintillation phosphors; the parameterization of quantum electrodynamics.

97. _____. Physics Division Quarterly Progress Report for Period Ending September 20, 1952. Feb. 12, 1953, 23 pp. ORNL-1415.

This report covers work on angular distribution of neutrons scattered from nitrogen; the $Al^{27}(p,n)Si^{27}$ threshold; the reactions $H^3(p,n)$ He^3 and $H^3(p,\gamma)$ He^{40}, reactions with the Cockcroft-Walton He^3 beam; lithium-6, helium-3, tritium; gamma-ray absorption and scattering; ratio of peak to total for a thallium-activated sodium iodide crystal; gamma-gamma angular correlations in Ta^{181} and Hf^{177}; paramagnetic scattering of neutrons by trivalent ions of neodymium and erbium; total cross section measurements with time-of-flight spectrometer; pile-oscillator measurements of stable-isotope cross sections; auger effect; quantum electrodynamics; nuclear three-body problem; scattering of slow neutrons by atoms with nonzero orbital moments.

98. CARLSON, A. B., AND BANKS, C. V. Spectrophotometric Determination of Silicon in the Presence of Zirconium, Beryllium, Aluminum, and Calcium. Ames Lab., Iowa State College, June 5, 1951, 23 pp. AECU-1375.

The molybdenum blue method, based on preliminary formation of molybdisilicic acid followed by reduction to a heteropoly blue complex, together with hydrofluoric acid treatment of the samples was chosen to fulfill the need for a rapid method for trace-silicon analyses. While devising procedures for various materials, it was necessary to study the

Generated on 2024-09-20 18:01 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

the various factors that affect color development. Results are presented that indicate the close relation existing between pH, fluoride concentration, and rate of formation of molybdisilicic acid. The reduction step was found relatively free of interferences. The use of hydrofluoric acid to ensure complete solution of the silica present is shown to be an invaluable adjunct to the method. The information presented should permit easy adaptation of the method to almost any type of material. The spectrophotometric method employed in this study was based principally on the work of Bunting. Preliminary treatment of the sample with hydrofluoric acid was taken from a paper by Case. A number of papers have been concerned with the analysis of silicon in the presence of fluoride. While devising procedures for determining silicon in the above-mentioned materials, it was found necessary to study the various factors that affect color development. The results of these investigations are included in this report.

99. CARLSON, O. N. Some Studies on the Uranium-Thorium-Zirconium Ternary Alloy System. Ames Lab., Iowa State College, June 5, 1950, 72 pp. AECD-3206; ISC-102.

Alloys of the uranium-thorium-zirconium system have been investigated by thermal, microscopic, and X-ray methods. The uranium-thorium binary system has been studied and a phase diagram proposed. In this system there is a eutectic at 1,086° C. and 3 weight-percent thorium. A region of liquid immiscibility exists above 1,375° C. between the compositions 8 weight-percent and 72 weight-percent thorium. A method of determining the boundary of the liquid area has been described. This method consisted briefly of maintaining the alloys at a constant temperature allowing the two liquid layers to separate and determining the composition of each layer by chemical analysis. The thorium liquidus, which rises sharply from the eutectic, was determined in a similar manner. Excess solid thorium dissolved was ascertained establishing a point on the liquidus curve. No solid solubility was observed in either component and no intermetallic compounds were found. The thorium-zirconium binary system has also been investigated, and a phase diagram, likewise has been proposed. There is a minimum in the solidus-liquidus curves at 1,275° C. and 25 percent zirconium. The solid solubility of zirconium in thorium has been estimated from X-ray measurements and from microstructures to be about 5 weight-percent zirconium. The solubility of thorium in alpha zirconium appears to be negligible. Above 900° C. in the region of beta zirconium the solid solubility in either component is more extensive. Microscopic examination of alloys quenched from above 900° C. indicates that a continuous solid solution region lies beneath the solidus line. Some evidence for a high-temperature allotropic form of thorium has been presented and its possible existence discussed. There is a eutectoid at 70 weight percent zirconium and 645° C. No compounds that are stable at room temperature were observed. The literature of the uranium-zirconium system has been reviewed. Beta zirconium and gamma uranium have been reported to exhibit extensive solid solubility in one another. Present investigations indicate that a eutectoid point exists at 687° C. and approximately 10 weight-percent zirconium. A preliminary survey of the ternary alloy system has failed to reveal a minimum in the liquidus at the three-component system.

CARMICHAEL, N. See abs. 873.

100. CARMODY, W. R. Electrolytic Valve Action of Zirconium. Trans. Electrochem. Soc., vol. 91, 1947, pp. 309-318. Pres. at 91st General Meeting of the Electrochemical Society held at Louisville, Ky., Apr. 11, 1947.

Zirconium is a suitable electrode material for an electrolytic rectifier when used with sulfuric acid as the electrolyte. Its behavior is virtually identical with that of tantalum, with the exception that its bread-down voltage is somewhat lower than that of tantalum.

Generated on 2024-09-20 18:06 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The current capacity of the zirconium electrolytic rectifier is limited by the rate at which it can dissipate the heat generated within the rectifier. A 5-ampere continuous rating rectifier was used to charge one to three 3-cell lead storage batteries and found to have a power efficiency varying from 43 percent to 68 percent depending upon the number of batteries placed in series. Evidence has been obtained that indicates that the obstruction to the passage of current through the zirconium electrode in the rectifier is essentially a potential barrier of approximately 6 volts.

See also abs. 504.

CARPENTER, G. B. See abs. 234.

101. CARPENTER, H. C. Methods of Growing Large Metal Crystals. Metal Industry (London), vol. 29, Oct. 29, 1926, pp. 409-411; Nov. 5, 1926, pp. 437-439.

This is a slightly condensed version of the Fourth Sorby Memorial Lecture delivered on October 22 before a meeting of the Sheffield Local Section of the Institute of Metals and of other local Societies devoted to Scientific and Metallurgical Research. The paper deals with the production of metals of ultra-purity and the influence of even the minute traces of foreign bodies on their physical, mechanical, and chemical characters.

102. CARPENTER, J. H., DETWEILER, J. C., GILLSON, J. L., WEICHEL, E. C., JR., AND WOOD, J. P. Mining and Concentration of Ilmenite and Associated Minerals at Trail Ridge, Florida. Min. Eng., vol. 5, No. 8, August 1953, pp. 789-795.

Ilmenite, rutile, and zircon are among other minerals found along the Florida coast. Recovery of the minerals is discussed. Includes a flowsheet of the Trail Ridge plant.

CECIL, O. B. See abs. 326.

CENTER, E. J. See abs. 895.

103. CERAMIC AGE. High-Temperature Ceramic Coatings for Molybdenum. Vol. 52, December 1948, pp. 312-313.

Scientific investigations at the National Bureau of Standards have been directed toward development of ceramic coatings for metals having very high melting points in order to protect them against oxidation at high operating temperatures. Results indicate that molybdenum with a specially designed ceramic coating offers a promising combination for very high temperature service.

CHAIKOFF, I. L. See abs. 343, 800.

CHALYBAEUS, W. See abs. 218, 219.

104. CHAMBERS, G. H. Zirconium. Metals and Alloys, vol. 4, December 1933, pp. 199-201.

This article is concerned only with the history, properties, and uses of finely divided zirconium metal. This form of metal is not ductile and cannot be rolled or worked into sheets, wire, or special shapes. Dr. J. H. deBoer of Philips Radio, Holland, has developed a thermal decomposition process in which nonductile zirconium metal powder is converted to zirconium tetraiodide and then decomposed to form a ductile rod of zirconium metal. This ingenious process is now operating on a commercial scale and it is possible to secure zirconium filaments, sheets, rods, spinneret cups, and plates. Sulfuric acid will not affect ductile zirconium. In one test, the metal was immersed in 68 percent sulfuric acid at a temperature of 72° C., and after 100 days the zirconium was still bright and was not corroded. There was no loss of weight during this period. The ductile metal is also resistant to alkalies. As a matter of fact, zirconium is, in this respect, far superior to other metals used in rayon spinnerets. It is not attacked by molten NaOH and is only slightly affected by molten KOH. A test was made by immersing it in 4 N

Generated on 2024-09-20 18:04 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

alkali hydroxide at 72° C., and there was no loss of weight or brightness after 25 days.

CHANDLEE, G. C. See abs. 18, 244, 820.

105. CHAPMAN, F. W., HUMMERS, W. S., TYREE, S. Y., AND YOLLES, S. Thermal Decomposition of $MeCl_4.2C_6H_5$ Coor Type Compounds. Jour. Am. Chem. Soc., vol. 74, No. 21, Nov. 5, 1952, pp. 5277-5279.

Zirconium tetrachloride-2-methyl benzoate, zirconium tetrachloride-2-ethyl benzoate, and the analogous ester addition compounds of hafnium tetrachloride undergo thermal decomposition to yield alkyl chloride and metal benzoate. Superimposed on this reaction, free metal chloride reacts with metal benzoate to form benzoyl chloride and oxygen-bridge polymers. Indications are that pure hafnium addition compounds decompose at a slower rate than the corresponding zirconium compounds. Residues from decompositions that are carried to completion are resin-like solids insoluble in all common solvents except concentrated sulfuric acid.

106. CHARLESBY, A. Electron and Photocurrents in Thin Films of Zirconium Oxide. Atomic Energey Research Est., AERE M/R 1015, England, 1952, 16 pp.; Acta Met., vol. 1, No. 3, May 1953, pp. 348-354.

The electron current i_- observed in thin oxide layers on zirconium depends on the average field F through the film $i_- = -2A_- \sinh B_-F$. The results obtained are consistent with a theory that the effect of the field is to assist electrons to move over a barrier that opposes their motion. If U_- and a_- represent the dimensions of this barrier, the theoretical formula for electron flow is as follows: $i_- = -2A_0 (-U/kT) \sinh (aeF/kT)$. The observed results give values for U and a of 0.375 e.v. and 3.6 Å. The quantity A_0 varies markedly with film age, and this tends to show that the electron current is associated with film imperfections which heal with time. Experiments with graphite on the oxide surface indicate that the electron current is not primarily due to impurities in the film. Photocurrents are observed when the oxide layer is exposed to ultraviolet light. These may be due in part to the destruction of some space charges in the film. These currents were not found to promote film growth and must therefore be electronic in character. Their variation with field strength is similar to that for the (dark) electron current. The constants U and a are different, however: 0.15 e.v. and 2.0 Å. Film age has no effect on the photocurrent, which cannot therefore be due to the healing of lattice imperfections but must be intrinsic to the oxide structure.

107. _____. Ionic Currents in Thin Films of Zirconium Oxide. Atomic Energy Research Est., AERE M/R 1014, England, September 1952; Acta Met., vol. 1, May 1953, pp. 340-347.

The electrical properties of thin oxide films on zirconium, formed by anodizing in suitable electrolytes, have been studied. This first report deals with the ionic currents and laws of growth. A second report will give these films, and a third report will deal with the effect of temperature on the oxide. Optical methods show the film to be uniform in structure and both optical and capacity measurements have been used to measure its thickness. At room temperature this is found to be proportional to the formation voltage and depends to a much lesser extent on the formation current. Owing to the uncertainty in the dielectric constant, a reliable value for the film thickness per unit of formation voltage cannot be given.

See also abs. 697.

CHEBINIAK, P. See abs. 687.

108. CHEMICAL ENGINEERING. Processing Metal Ores. ..Zirconium Powder. Vol. 59, No. 8, August 1952, pp. 330-332.

Generated on 2024-09-20 18:06 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

A brief news item on the uses of zirconium powder.

109. CHEMICAL ENGINEERING AND MINING REVIEW. Beach Sands Industry. Nov. 10, 1952, pp. 47-48.

At several points on the coast south of Brisbane and around Moreton Bay the beach sands contain sufficient concentrations of such valuable minerals as rutile, zircon, monazite, and ilmenite, to render their commercial treatment economically attractive. There are several operating companies, including: Titanium and Zirconium Industries Pty., Ltd., which operates on north Stradbroke Island and Mineral Deposits Syndicate, and Rutile Sands Pty., Ltd., and Associated Minerals Pty., Ltd., which operate on the South coast.

110. CHEMICAL AND ENGINEERING NEWS. Better Procedures Needed for Analysis of Less Common Metals. Vol. 31, No. 27, July 6, 1953, pp. 2766-2767. (Pres. ACS Div. Analy. Chem., Summer Symposium, June 19, 20, 1953, Rensselaer Polytechnic Inst.)

A discussion of the need for better analytical procedures for the less common metals.

111. _____. Difference Noted in Behavior of Zirconium and Hafnium. Vol. 32, No. 6, Feb. 8, 1954, pp. 482, 484.

Resemblance of hafnium to zirconium continues in high-temperature applications, with one important exception, according to Oak Ridge National Laboratory. The monoclinic lattice of zirconia undergoes an inversion at 1,000° C. to a tetragonal form; this change is accompanied by a large shrinkage in volume. Inversion is completely reversible, so that zirconia refractories tend to shatter if they are heated and cooled repeatedly. On the other hand, hafnium oxide remains in monoclinic form up to 1,700° C., where an inversion takes place. Whether inverted form is tetragonal has not yet been established. The inversion is not accompanied by as marked a volume change as is undergone by zirconia.

112. CHEMICAL MINING REVIEW. Flotation of Zircon. Vol. 41, May 10, 1949, pp. 283-285. (Abstracted from Interim Rept. 1 (Flotation of Zircon), Investigation 303 (The Concentration of Beach Sand) of the Metallurgical Laboratory, University of Melbourne.)

A four-stage process consisting of soap treatment, followed by water washes, acid wash and flotation has been developed for obtaining high recoveries of zircon in a high-grade concentrate from beach-sand deposits of eastern Australia.

113. CHEMICAL AND PROCESS ENGINEERING. Australian Chemical and Engineering Research. December 1952, pp. 674-676.

A wide range of chemical and chemical engineering research is done by the Australian Commonwealth Scientific and Industrial Research Organization, which has recently published its third annual report on work carried out up to the middle of last year. Substantial progress has been made on the many research projects started by the Division of Industrial Chemistry during the previous year. Brief details of the present investigations on chemical engineering, fuel technology, physical and organic chemistry, cement and ceramics, metallurgy, and ore dressing and nuclear physics are described. Work described in the organization's first and second annual reports was summarized in the September 1950 and November 1951 issues of this journal.

114. CHEMICAL WEEK. End of the Trail: Zirconium. Vol. 72, No. 2, Jan. 10, 1953, pp. 32-36.

From many standpoints, zirconium is the answer to design engineering problems. It has a high melting point (about 1,830° C.), is resistant to most acids and alkalis, and virtually immune to salt water. Because of its low neutron absorption, it's the Atomic Energy Commission's material of choice for many nuclear reactor applications. This

Generated on 2024-09-20 18:09 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

article is a general discussion on the above points.

115. CHESTERS, J. H. Recent Progress in Refractories. Ceram. Age, vol. 56, No. 3, September 1950, pp. 16-17.

Reviews a number of refractory materials, including discussion of zircon.

116. CHIOTTI, P. Summary of Research on Experimental Refractory Bodies of High-melting Nitrides, Carbides and Uranium Dioxide. Iowa State College, Ames Lab., ISC-44, May 5, 1950, 24 pp. AECD-3204.

A procedure for the preparation of the nitrides and carbides of several metals and the preparation of refractory bodies from them is described. The investigation shows that reasonably strong and dense bodies can be prepared from these materials as well as from UO_2. Evidence showing the tendency toward instability at high temperatures of Be_3N_2, TaN, and ThN is presented. Evidence is also given indicating that the hexagonal structure reported by others for TaN is actually that for Ta_2N. A lattice for Th_2N_3 is proposed. The melting points of ThN, UN and UC are determined to be 2,630 ± 50° C., 2,650 ± 100° C., and 2,950 ± 50° C., respectively.

CHUBB, W. See abs. 795.

117. CIBULA, A. Mechanism of Grain Refinement of Sand Castings in Aluminum Alloys. Jour. Inst. Metals, vol. 76, No. 7, December 1949, pp. 321-360.

The work described in this paper was carried out to determine the mechanism of and to secure greater control of the grain refinement of aluminum casting alloys of the solid-solution type and, in particular, to find ways of preventing grain coarsening and increasing the efficiency of refinement.

118. CLABAUGH, W. S., AND GILCHRIST, R. Method for Freeing Zirconium of Common Impurities and Preparing Zirconium Sulfate and Oxide. Jour. Am. Chem. Soc., vol. 74, No. 8, Apr. 20, 1952, pp. 2104-2105.

The complex nature of zirconium salts and the incomplete knowledge of their chemistry have made it a matter of considerable difficulty to purify zirconium compounds. In the course of a project on the separation of hafnium from zirconium, observations were made which should prove useful in manipulating certain reactions whereby zirconium can be freed of its common impurities.

119. CLARK, G. L., AND REYNOLDS, D. H. Chemistry of Zirconium Diozide X-ray Diffraction Studies. Ind. Eng. Chem., vol. 29 No. 6, 1937, pp. 711-715.

When $ZrOCl_2.H_2O$ is heated at 110° C., it loses its water of hydration and becomes amorphous. Between 300° and 500° C. it is transformed to zirconia. The tetragonal modification of zirconia is formed at 500° C. and is converted to monoclinic baddeleyite above 600° C. When zirconyl hydroxide is ignited at 650° C., it first forms tetragonal zirconia, which is then converted irreversibly to the monoclinic form. Complete conversion requires considerable time at that temperature. When zirconyl hydroxide is ignited at 500° C., tetragonal zirconia is formed, which shows no tendency to change to monoclinic even upon long heating at this temperature. The low-temperature tetragonal form of zirconia is probably identical in structure with the form that is stable between 1,000° and 1,900° C. The slow conversion rate of the low form may be due to its extremely small crystal size. Silica exhibits some solubility in tetragonal zirconia. The dissolved silica stabilizes the tetragonal form to raise the transition temperature from 600° to above 1,000° C. The silica-zirconia solution is converted to zirconium silicate (zircon) at 1,460° C.

CLEGG, J. W. See abs. 841.

120. CLEWETT, G. H., AND KUHN, D. W. Proposed Method of Determining the Vapor Pressure of Zirconium

Generated on 2024-09-20 18:03 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Tetrachloride and Hafnium Tetrachloride in the Liquidus Region. Carbide and Carbon Chem. Corp., June 20, 1949, 8 pp. Y-430.

A proposal has been submitted and approved for determining the vapor pressure of zirconium and hafnium tetrachlorides in the liquidus region. The purpose of this paper is to outline the procedures used to obtain this information.

COBLE, R. L. See abs. 657.

COHN, W. E. See abs. 888.

121. COHN, W. M. Crystal Modifications of Zirconia. Trans. Electrochem. Soc., vol. 68, 1935, pp. 65-71.

In the commercial production of refractory articles made of zirconia, irregularities such as cracking and disintegration were observed. The cause for the occurrence of these failures was investigated, using the thermal expansion of ZrO_2 under various conditions as a direct means of detecting any changes occurring in the compound. The results obtained were correlated with crystal studies and X-ray patterns. It was found that ZrO_2 can be prepared in three distinct modifications with widely different expansion coefficients, a tetragonal and a trigonal one. The monoclinic modification is stable between room temperature and 1,000° C. On the basis of these observations, it was possible to so regulate the temperatures in the manufacture of zirconia refractories as to eliminate cracking and disintegration. Clear, fused zirconia was prepared in the sun furnace at temperatures exceeding 2,700° C. This furnace focuses the sun's energy onto a small holder through which a compressed rod of ZrO_2 is slowly passed. Clear fused zirconia has a yellowish tint, is extraordinarily hard, and is very resistant to acids and slags.

COLLETTE, R. L. See abs. 235.

COLTERYAHN, L. E., JOSEPH, W., RAY, W. E., AND READ, H. J. Corrosion of Zirconium. See abs. 720.

_____. Corrosion of Zirconium. See abs. 721.

COLTERYAHN, L. E., RAY, W. E., AND READ, H. J. Corrosion of Zirconium. See abs. 719.

122. COLUMBIA UNIVERSITY. Quarterly Report Nuclear Physics Laboratories. June 30, 1951, 31 pp. CU-96.

The total neutron cross sections of rhenium, tantalum, gallium, and lithium have been obtained with the slow neutron velocity spectrometer. A new arc modulator has been installed in the velocity selector and changes are being made in the power supplies for both arc source and velocity selector. The capture slope and thermal cross section of tellurium have been found. Work continues on the measurement of its resonances with the velocity selector. Neutron mirrors are being prepared for determining the coherent cross sections of tellurium isotopes and phosphorus, utilizing the Brookhaven Pile. A capture resonance in strontium at 3.5 ev has been located using the immediate γ's from neutron capture as detector. Resonances in Cd and Ba have been confirmed. A method of analyzing these resonances for the scattering apparatus is being extended. Further neutron transmission data on FeF_3 and Na_3FeF_6 were obtained for the paramagnetic scattering study. The preparation of pure samples of iron carbonyls is under way. Experimental work was completed on the resonance absorption method of determining indium in tin and hafnium in zirconium. Theoretical curves were calculated for various parameters for use in the evaluation of resonance absorption data. A variety of sources was prepared for the β-spectrometer. Two samples of enriched Ag^{109} were prepared for neutron spectrometer use by electrodeposition. Rhenium deposits of various thicknesses were prepared as critical absorbers. The preparation of phosphorus, sulfur, and tellurium mirrors was begun for use in

Generated on 2024-09-20 18:03 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

neutron mirror experiments. Further progress was made in the preparation of standard boron transmission targets. A quick recovery amplitude discriminator with a rise time less than 10^{-8} sec. and recovery of 10^{-7} sec. has been developed and modified to function on negative as well as positive pulses. Further progress has been made on a slow neutron scintillation counter, which uses a multiplicity of thin alternating layers of boron and zinc sulfide phosphor. Various electronic devices have been completed and are waiting test. These include an electronic cyclotron probe tester, a linotron model, and an ultrawide band distributed amplifier using pencil triodes. The slotted line equipment for making the measurements on these units has also been completed and is in operation condition.

COMMONS, C. H., JR. See abs. 486, 487.

123. COMSTOCK, G. F. Lining a Small Induction Furnace. Metal Progress, vol. 36, December 1949, pp. 759-760.

A discussion of the use of zircon instead of magnesia for crucibles and furnace linings.

124. _____. Some Experiments With Zircon and Zirconia Refractories. Jour. Am. Ceram. Soc., vol. 16, 1933, pp. 12-35.

This is a record of the results of 5 years' research on refractory uses for a chemically purified grade of zircon and electrically fused zirconia of high purity. The products investigated included semipermanent foundry molds, refractory brick and cements, ladle nozzles, and crucibles. Describes electric firing and a small oil-fired tunnel kiln. Discusses the effects of various binders. Sintered zircon grog was found superior to electrically fused grog. Zircon brick made with 50 percent grog, using 20 percent milled zircon for the permanent bond and fired at 1,600° C. for an hour, showed no firing shrinkage, very slight volume change and high compressive strength at 1,600° C. They were extremely resistant to spalling but did not resist basic slags or metallic oxides very well at high temperature. Zircon-bonded magnesite brick were more refractory than ordinary magnesite, more resistant to spalling and had about the same slag resistance as magnesite. Zirconia was more refractory than zircon and had better slag resistance. Lime-bonded zirconia crucibles of good spalling resistance were made, but the cost was higher than that of zircon.

125. COMSTOCK, G. F., AND BANNON, R. E. Heat-Treated Copper Castings Alloyed With Zr and Be. Metals and Alloys, vol. 8, April 1937, pp. 106-109.

The alloys of copper and zirconium have been described by Allibone and Sykes (Jour. Inst. Metals, No. 1, 1928, pp. 173 and No. 1, 1929, pp. 179) and according to these investigators zirconium hardened copper without remaining in solid solution to any appreciable extent. This characteristic led to the thought that copper castings might be hardened by zirconium without decrease in conductivity such as is produced by most other hardening agents. To investigate this, a number of alloys were made up and tested. It was found that the alloys were susceptible to temper-hardening. More alloys were tested and results are given in this article.

CONKLIN, G. L. See abs. 565.

CONN, E. E. See abs. 785.

126. CONNICK, R. E., AND McVEY, W. H. Aqueous Chemistry of Zirconium. Radiation Lab., University of California, Sept. 9, 1948, 67 pp. AECD-2272.

A system involving a two-phase equilibrium was used to study the chemistry of zirconium in the +4 oxidation state in dilute acid solution. The equilibrium studied was one between the various zirconium species in an aqueous phase and the thenoyltrifluoracetone chelate of zirconium in a benzene phase. From this study, it was shown that the zirconium species in 2.00 M perchloric acid is principally $ZrOH^{+3}$, which hydrolyzes

Generated on 2024-09-20 18:09 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

further at acidities to form $Zr(OH)_2^{+2}$. Equilibrium quotients were obtained for the equilibria existing between $ZrOH^{+3}$ and zirconium species complexed by one and two sulfate groups in 2.00 M $HClO_4$. It was established that in a 2.00 M solution, 0.015 M in bisulfate ion, there is an average of 1 sulfate group per zirconium and 2 sulfate groups per zirconium at a bisulfate concentration of 0.2 M. The fluoride complexes of zirconium in 2.00 M $HClO_4$ were found to be by far the most stable of any of the complexes studied. Values for the equilibrium quotients for reactions involving complexing of zirconium by 1, 2, and 3 fluoride ions were obtained. At a hydrofluoric acid concentration of 2×10^{-5} M, there is an average of 1 fluoride group per zirconium; at 3×10^{-4} M, an average of 2 fluoride ions per zirconium, and at 10^{-2} M hydrofluoric acid an average of 3 fluorides attached to each zirconium. The oxalate complex of zirconium is very stable even in 2 M $HClO_4$, whereas the next three members of the aliphatic, diabasic acids show little tendency toward complexing. Chloride and nitrate ions form only weak zirconium complexes of nearly equal stability.

127. CONNICK, R. E., AND REAS, W. H. Hydrolytic Behavior of Zirconium in Perchloric Acid Solution. Radiation Lab., University of California, September 1948, 26 pp. AECD-2491. Also appeared as: Hydrolysis and Polymerization of Zirconium in Perchloric Acid Solution. Jour. Am. Chem. Soc., vol. 73, March 1951, pp. 1171-1176.

The polymerization of zirconium (IV) in 1 M and 2 M perchloric acid solutions has been investigated. The extraction of the zirconium chelate of thenoyltrifluoracetone into benzene was measured as a function of the zirconium concentration. Polymer formation is quantitatively reflected as a decrease in the extraction coefficient of the zirconium, and equations expressing this relationship have been developed and applied to the data.

CONWAY, J. B. See abs. 314.

128. CONWAY, J. G., AND MOORE, M. F. Spectrochemical Analysis of Hafnium and Zirconium. Radiation Lab., University of California, Mar. 16, 1949, 8 pp. AECD-2582; UCRL-304.

The analysis of hafnium and zirconium by the copper spark technique is presented for solutions of HCl, HF, and $HClO_4$ acids. The special techniques of electrode protection and vacuum drying of perchloric acid samples are outlined. Also given are the working curves and deviations of both elements.

129. COOLEY, R. A., MARTIN, A. V., FELDMAN, C., AND GILLESPIE, J. Hafnium to Zirconium Abundance Ratio and Specific Radioactivity of Some Ores. Geochim. Cosmochim. Acta (London), vol. 3, 1953, pp. 30-33.

The hafnium to zirconium abundance ratio and the specific radioactivity of some ores from different continents were measured spectroscopically and by Geiger counter, respectively. Hevesy's postulation of a relationship between the radioactivity and hafnium content of zircons and the possibility of the abundance ratio serving as a geological indicator are discussed.

130. COOPER, H. S. Preparation of Fused Zirconium. Trans. Am. Elecrchem. Soc., 1923, pp. 215-230. Pres. 43d General Meet. Am. Electrochem. Soc., New York, N. Y., May 5, 1923.

Describes a process for preparing zirconium and a number of its alloys. Gives the experimental data on the establishment of the melting point of zirconium metal.

COOPER, H. W. See abs. 62, 63.

COPP, D. H. See abs. 466.

CORENZWIT, E. See abs. 247.

Generated on 2024-09-20 18:06 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

131. CORSON, B. B., JONES, H. E., WELLING, C. E., HINICKLEY, J. A., AND STAHLY, E. E. Butadiene From Ethyl Alcohol. Ind. Eng. Chem., vol. 42, No. 2, January-December 1950, pp. 359-373.

The wartime research in this country on the production of butadiene from ethyl alcohol was centered around the American two-step process, but exploratory studies were allocated to the possible competitive Russian one-step process. The best catalysts for the one-step process were oxide mixtures of silicon-magnesium-chromium and the best yield obtained in the laboratory (at 400° to 425° C.) by the one-step process was 56 percent of the theoretical, as compared with 64 percent produced by the two-step American process at the considerably lower temperature of 350° C. The same general areas in the periodic system were effective for both processes - mainly, the fourth and fifth groups, with less activity in the second and sixth groups - but the specific catalysts for the two processes were not interchangeable. The American two-step process comprised dehydrogenation of ethyl alcohol to acetaldehyde, followed by the catalysis of ethyl alcohol-acetaldehyde to butadiene. Intensive study of the second step indicated maximal catalytic activity to reside in combinations of silica with oxides of certain transitional elements of the fourth and fifth groups. In general, tantala-silica combinations showed their highest activities at 350° C., whereas zirconia-silica and hafnia-silica combinations performed best at 300° C. The per pass yield of butadiene with better catalysts was 30 - 35 percent and the ultimate yield was 60 - 64 percent. The impregnation step in the preparation of silica-base catalysts was equally effective when applied to dried granular silica gels and to slurries of hydrogels.

132. CORVELL, C. D., SAKAKURA, A. Y., AND ROSS, A. M. Fission Yields of 65-Day Zr^{95} and 17-Hr. Zr^{97}; Search for Other Zr and Nb Fission Chains. Phys. Rev., vol. 77, 1949, p. 755.

An abstract of an article on the subject of zirconium fission activities in work carried out at the Massachusetts Institute of Technology.

133. COSTER, D. On the X-ray Spectra of Hafnium and Thulium. Phil. Mag., vol. 46, 1923, pp. 956-964.

Gives details of physical methods used during the investigation of the X-ray spectra of hafnium and thulium. Includes tables of wave-lengths of X-ray lines for hafnium and thulium.

134. COSTER, D., AND HEVESY, G. On the Missing Element of Atomic Number 72. Nature, vol. 111, No. 2777, Jan. 20, 1923, p. 79.

This article is a discussion of the discovery of the element No. 72, hafnium, in 1923.

135. _____. On the New Element Hafnium. Nature, vol. 111, No. 2780, Feb. 10, 1923, p. 182.

A discussion on the discovery of the element hafnium in 1923.

136. _____. On the New Element Hafnium. Nature, vol. 111, No. 2782, Feb. 24, 1923, p. 252.

A discussion on the discovery of the element hafnium in 1923.

COTTLE, D. L. See abs. 378.

137. COX, F. G. Ductile Welding of Zirconium. Murex Rev., vol. 1, No. 11, 1952, pp. 245-279; Weld. Res. Sup., February 1953, pp. 92-S - 98-S.

Production of ductile welds in zirconium, titanium and tantalum has been mentioned in the literature, but no details are given beyond the statement that when heated to a temperature of 1,200° F. or above all metals must be completely shielded. In the case of zirconium, however, it has been reported that welds made using direct current are significantly more ductile than those made under

Generated on 2024-09-20 18:06 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

similar conditions with alternating current. The scarcity of published information increases interest in the subject. Describes the experiments made to determine the conditions necessary for producing ductile welds in zirconium, discusses the chemical and physical properties of the welds, and gives an account of the developments needed to adopt the process to production practice.

138. CRAFTS, W., AND LAMONT, J. L. Effect of Some Elements on Hardenability. Am. Inst. Min. Met. Eng., Tech. Pub. 1657, 1944, 11 pp.

An investigation has been made of the multiplying factors for some of the more common alloying and deoxidizing elements for use in calculating hardenability of steel according to Grossmann's method. The factors for manganese, silicon and aluminum that were reported in an earlier communication have been confirmed by microscopic determination of the half martensite structure rather than on the basis of an empirically determined hardness corresponding to a half-martensite structure. Measurement of ideal critical diameter by microscopic examination was found to be necessary for other alloying elements, and multiplying factors for nickel, chromium, molybdenum, zirconium, vanadium, titanium, and boron have been determined. The nature and order of magnitude of the multiplying factors reflect the effect of the alloying elements on the structural character of the steel. Except for nickel and vanadium, the multiplying factors agree fairly well with previously published results. Good correlation between actual and calculated ideal critical diameters has been found in developing the multiplying factors and in checking the results against fairly simple steels. However, some discrepancies have suggested the need for a more thorough study of low-carbon and complex steels.

139. _____. Some Effects of Deoxidizers in Low Carbon-1.5 Percent Chromium Steel. Jour. Am. Soc. Metals, vol. 27, March 1939, pp. 268-288.

In order to determine the reasons for differences between the properties of a similar fine-grained steels, the 'core' properties of 1.5 percent chromium carburizing steels treated with graduated amounts of aluminum, vanadium, and zirconium have been investigated. Using the tensile strength and the distortion of a tuning fork type of specimen as criteria of hardening characteristics, it has been shown that the differences in properties result from changes in the mode of transformation of austenite. The amount and kind of deoxidizer have been found not only to have an appreciable influence over the austenite transformation in one section, but also to determine the differences between light and heavier sections. More accurate control and more desirable combinations of properties have, therefore, been shown to be obtainable by accurate control of the residual deoxidizer content and the use of combinations of deoxidizing elements.

CREAMER, A. S. See abs. 246.

CROWLEY, J. See abs. 800.

140. CUBICCIOTTI, D. Melting Point-Composition Diagram of the Zirconium-Oxygen System, Technical Report No. 6, Reactions of Metals with Gases at High Temperatures. Illinois Inst. Technol., May 1950, 10 pp.; Jour. Am. Chem. Soc., vol. 75, No. 5, May 1951, pp. 2032-2035.

The solidus curve of the zirconium-zirconium dioxide system has been determined by observing the melting points of wires of the oxidized metal. The results show that near the melting points oxygen dissolves to the extent of 55 atom percent in solid zirconium metal, whereas zirconium dissolves in the solid dioxide to form a 15 mole percent solution. No evidence was found for compounds other than the dioxide.

See also abs. 54.

141. CUBICCIOTTI, D. D., DRAVNIEKS, A., AND BLEVITZKY, R. Reactions of Gases With Metals at High Temperatures,

Generated on 2024-09-20 18:08 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Yearly Report, April 1, 1948 - April 1, 1949. Illinois Inst. Technol., April 1949, 49 pp. NP-1003.

The rates of reaction of zirconium metal with oxygen gas have been measured at temperatures from 600° to 920° C. and pressures of a few centimeters of mercury. The rates are expressed by equations of the form $w^x - kt$, where w is the weight of oxygen consumed in time, t, k is a constant, and x is found to be a function of pressure. The oxides produced in the reaction were identified as mixtures of monoclinic and tetragonal zirconium dioxide. Describes a system for producing oxygen gas containing an excess of atomic oxygen. The concentration of atomic oxygen was measured as a function of the variables of the system. A comparison of the rates of oxidation of copper in active and ordinary oxygen was made at temperatures of 500° to 690° C. and pressures of 0.5 mm. to 2.0 mm. mercury. The rates were found to be close to parabolic, with the reaction in active oxygen usually more rapid than, or as rapid as, the reaction in ordinary oxygen, except in one case where active oxygen promoted the formation of cupric oxide and decreased the overall rate of oxidation as a result. Analysis of the scales showed that cuprous oxide formed only on short periods of oxidation, a mixture of cuprous and cupric oxides formed on long oxidations, and active oxygen hastened the formation of cupric oxide. The rates of oxidation of a few other metals were compared in active and ordinary oxygen. Several problems are proposed for investigation during the next year.

142. CUNNINGHAM, T. R., AND PRICE, R. J. Determination of Zirconium in Plain Carbon and Alloy Steels. Ind. Eng. Chem., anal. ed., vol. 5, No. 5, Sept. 15, 1933, pp. 334-335.

Gives procedure, equipment, and results based on the rapid precipitation of $Zr(HPO_4)_2$ in the presence of varying amounts of a number of other elements.

143. _____. Determination of Zirconium in Plain Carbon and Alloy Steels. Ind. Eng. Chem., anal. ed., vol. 3, No. 1, Jan. 15, 1931, pp. 105-106.

Gives procedure, equipment, and results based on the rapid precipitation of $Zr(HPO_4)_2$ in the presence of varying amounts of a number of other elements.

144. CURTIS, C. E. Development of Zirconia Resistant to Thermal Shock. Jour. Am. Ceram. Soc., vol. 30, No. 6, 1947, pp. 180-196.

The effects on the crystal stabilization and other properties of pure zirconium were determined for additions of CaO, MgO, BeO, ThO_2, and CeO_2 in binary and ternary combinations. Complete stabilization was attained with the following compositions (in mol. percent): 10 to 20 CaO, 14 MgO, 26 CeO_2, 10 CaO + 5 ThO_2, 10 CaO + 5 BeO, or 2 to 7 CaO + 4 to 6 to MgO. Cerium oxide produced partial stabilization, but BeO and ThO_2 used alone were ineffective at 1,927° C. Some strong, dense bodies were found which had good resistance to thermal shock, namely those containing (mol. percent) 8 to 12 CaO, 6.7 CaO + 3.7 MgO, or 2.3 CaO + 6.4 MgO; all of these compositions still had a small amount of inversion present. This small inversion may be necessary for high resistance to thermal shock in ZrO_2 ware because (1) the overall thermal expansion is then small and gradual and (2) with complete elimination of inversion the expansion is large since the expansion curve is a straight line and the coefficient of expansion is rather high, 11 to 12 x 10^{-6}.

145. CURTIS, C. E., AND LAURIE, D. Investigations of Various Properties of Zircon and of Stabilized Zirconia at Elevated Temperatures; Part I, Reaction of Zircon and of Stabilized Zirconia With Various Refractories at Elevated Temperatures; Part II, Heat-Transfer Rates Through Stabilized Zirconia; Part III, High-Temperature Load Testing. Jour. Am. Ceram. Soc., vol. 33, No. 6, June 1950, pp. 198-207. (The three parts of this report have appeared as individual reports in other bibliographies.)

Generated on 2024-09-20 18:14 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The reactions of zircon and of stabilized zirconia in contact with each of 14 commercial refractories at temperatures ranging from 2,400° to 3,600° F. were studied. A heating schedule of 4 hours with 1 hour at maximum temperature was used, and the safe upper limits to avoid reaction between both zirconia and zircon and the various refractories were established. To correlate this information with commercial high-temperature furnace installations, tests were made to determine the heat-transfer rates through stabilized-zirconia brick of both the dense and the insulating types. The hot-load resistance of the commercial refractories was determined, using a small oxyacetylene-fired furnace in which 1-in.-cube samples were heated from all sides under a 25-lb. load. Studies were made of the effect on hot-load resistance of variations in (1) load, (2) holding temperature, and (3) dimensions of the test piece. Other tests were designed to demonstrate the large increase in hot-load resistance obtained when the specimen was heated from one side only, as in a furnace wall.

146. CURTIS, C. E., AND SOWMAN, H. G. Investigation of the Thermal Dissociation, Reassociation, and Synthesis of Zircon. Jour. Am. Ceram. Soc., vol. 36, No. 6, June 1953, pp. 190-193.

The amount of dissociation present in zircon after 2-hour heating periods at between 2,800° and 3,600° F. was determined by X-ray analysis of quenched specimens. The course of dissociation was followed in the same manner during 8- to 10-hour heating periods at 2,800°, 3,000°, and 3,200° F., respectively. Data are included that pertain to the synthesis of zircon from its constituent oxides at from 2,100° to 2,800° F. The results indicate that zircon is the stable phase up to about 2,800° F., above that temperature it becomes unstable, the degree of instability increasing with temperature, especially above 3,200° F. On the basis of the results obtained from this investigation, a revision of the present phase diagram of the system zirconia-silica is proposed.

147. CUSHMAN, B. E. Summary of the Research Progress Meeting of March 8, 1951. University of California Radiation Lab., UCRL-1206, June 27, 1951, 6 pp.

Covers discussions on radiochemical studies on isotopes of zirconium, photomesons from deuterium, and photomesons from helium.

DABAGIAN, H. J. See abs. 418.

DABBS, J. W. See abs. 739.

150. DAVEY, W. P. Crystal Structure of Zirconium Oxide. Phys. Rev., vol. 27, 1926, p. 798.

ZrO_2 appears to crystallize in several forms. Powder metallurgy methods were used to interpret the diffraction patterns. This is an abstract of work performed by General Electric Co.

DAVIES, M. W. See abs. 369.

DAVIES, T. A. See abs. 348.

DAVIES, T. H. See abs. 249.

DAVIS, J. A. See abs. 400.

151. DAVIS, P. C. Determination of Fluorine in Zirconium Metal. Ames Lab., ISC-83, Iowa State College, May 10, 1950, 3 pp.

Describes a procedure wherein microgram quantities of fluorine in zirconium metal are quantitatively determined by oxidizing the metal sample in a stream of moist oxygen in a platinum reaction tube. The hydrofluoric acid formed in the reaction is collected by condensing the water vapor and determined by a colorimetric titration with thorium nitrate using sodium alizarin sulfonate indicator.

152. DAYTON, R. W., ALLEN, C. M., AND EBERTS, W. U. Reclamation of

Generated on 2024-09-20 18:10 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Zirconium Machining Chips to Produce Arc-Melting Feed Stock. Battelle Mem. Inst., October 24, 1952, 7 pp. AECD-3499.

This study has shown that it is possible to remove most of the surface contamination of zirconium chips and produce a material with essentially the same composition as the material from which the chips were cut. Thus, it should be possible to use the chips in the same manner as heavier zirconium scrap, as melting stock. If the material is to be remelted, some method of consolidating the long stringy chips into suitable melting stock will be required. A little work on this subject was done, and, although no satisfactory method was developed, promising avenues of attack were found. The study was terminated in favor of larger scale tests in chemical plants. For that reason, no detailed cost analysis of processing was made. However, it appears that costs should be reasonable, the largest being 10-15 percent metal loss in pickling.

153. DEADMORE, D. L. Effect of Thermal Shock and Annealing on Certain Physical Properties of a Zircon Body. Ceram. Age, vol. 55, No. 1, January 1950, pp. 17-20.

The objective of this article is to present some numerical values for various physical constants of a zircon body as a function of the quenching temperature. The effect of annealing a quenched body also has been investigated.

154. DEAN, R. S., AND GOTTSCHALK, V. H. Uncommon Metals. Eng. Min. Jour., vol. 141, No. 2, February 1940, pp. 92-93.

Lanthanum, prepared by electrolyzing its fused chloride, is latest addition to list of uncommon metals. Progress in reduction and use of various other metals including zirconium are included.

155. DEAN, R. S., AND SILKES, B. Metallic Titanium and Its Alloys. Bureau of Mines Inf. Circ. 7381, November 1946, 38 pp.

Titanium is estimated to comprise about 0.65 percent of the earth's crust and to be the ninth most abundant element. It ranks fourth in abundance among metallic elements suitable for engineering uses and is exceeded only by aluminum, iron, and magnesium. The titanium industry revolves around the production of ilmenite and rutile. Ilmenite is used to manufacture titanium dioxide, largely employed as a white pigment in paints, but is also utilized in alloys, cemented carbides, and other metallurgical applications. Rutile is used principally for welding-rod coatings, but also for alloys. Titanium dioxide is ordinarily produced from ilmenite by digesting with fuming sulfuric acid, filtering and clarifying the solution of iron and titanium sulfates, reducing the iron to the ferrous state, and precipitating TiO_2 by hydrolysis.

156. de BOER, J. H., AND FAST, J. D. /Electrolysis of Solid Solutions of Oxygen in Metallic Zirconium./ Rec. trav. chim., vol. 59, 1940, pp. 161-167.

Further particulars are given regarding the solubility of oxygen in zirconium. It is shown that the oxygen atoms are present in the interstices of the zirconium lattice and that at high temperatures they have a great mobility in the lattice. Under the influence of an electric field, it is found that under suitable conditions of temperature and potential drop the oxygen moves through the metal lattice as a negative ion, causing the oxygen concentration (and with it the electrical resistance) to increase at the anode end and to decrease at the cathode end.

157. _____. /Influence of Oxygen and Nitrogen on the α - β Transition of Zirconium./ Rec. trav. chem., vol. 59, 1940, pp. 459-467.

The effect of dissolved oxygen and nitrogen upon the α - β transition of zirconium was investigated by measuring

Generated on 2024-09-20 18:09 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

the electrical resistance of rods. Upon the addition of oxygen or nitrogen the transition temperature changes from a sharp 865° ± 10° C. to a temperature range that is ascribed to an equilibrium in a system in which the number of components has been increased from one to two without increasing the number of phases. The dissolution of both gases adds a third component without adding a phase. Under these latter conditions hysteresis phenomena are observed. The character of the resistance curves is not affected appreciably by the addition of aluminum.

DECKER, B. F. See abs. 392.

158. DELAHAY, P., AND STAGG, L. J. Polarographic Method for the Indirect Determination of Polarization Curves for Oxygen Reduction on Various Metals. Jour. Electrochem. Soc., vol. 99, No. 12, December 1952, pp. 546-548.

Polarization curves for the electrolytic reduction of oxygen are determined for several metals by applying a polarographic method previously described. The contributions of the two and four electron processes, that is, reduction of oxygen to hydrogen peroxide and to water, respectively, are determined. The electrolytic reduction of oxygen on chromium, tantalum, titanium, and tungsten may yield appreciable quantities of hydrogen peroxide. Very little hydrogen peroxide is formed on zirconium and molybdenum.

159. DeLANGEN, K. W. Auger-Effect and Relative Intensity of L-Emission Lines. Physica, vol. 6, No. 1, January 1939, pp. 27-32.

The relative intensities of the lines $L\beta_1$, $L\beta_3$ and $L\beta_4$ are determined for Zr, Nb, and Mo by a photographic method. The lines $L\beta_3$ and $L\beta_4$ relative to $L\beta_1$ are more intense for Mo than for Zr and Nb. This is in accordance with the theory of Coster and Kronig for the Auger-effect $L_I \rightarrow L_{II}$ with injection of an M_{IV} v electron, which can take place for Zr but not for Mo, since for this the energy difference L_I-L_{II} is too small. Also the intensity of satellites of $L\beta_1$ for the same elements has been measured.

de MONSABERT, W. R. See abs. 456.

160. DEMPSTER, A. J. Atomic Masses of the Heavy Elements. Phys. Rev., vol. 53, Jan. 1, 1938, pp. 64-75.

Comparisons have been made between a series of different atomic masses using a double-focusing mass spectrograph. The small displacement between the positions of multiple charged ions of one mass and atoms of another mass is measured and gives a value for the difference in the packing fractions of the two atomic masses. The following pairs of ions have been compared: O^+-Ti^{+3}, C^+-Ti^{+4}, N^+-Fe^{+4}, O^+-Cu^{+4}, Al^4-Ag^{+4}, Cu^+-Au^{+3}, Ti^+-Au^{+4}, Cu^+-Pt^{+3}, Sn^+- Th^{+2}, Sn^+-U^{+2}, Sn^+-U^{+2}, Sn^+-AcU^{+2}, Zr^+- W^{+2}, (91, 92), Mo^+-Pt^{+2}(96, 97, 98), Mo^+-Ir^{+2}, Pd^+-Pb^{+2} (102, 104), Rh^+-Pb^{+2}, Pd^+-Tl^{+2}, Pd^+-Bi^{+2}, Ru^+-Os^{+2} (96), Ru^+-Pt^{+2}(99), Pd-Ga^+. Less exact comparisons have also been made between the following pairs: Mo^+-Os^{+2} (94, 95, 96), Ag^{+5}-Zn^{+3}, Na^+-Zn^{+3}, Sn^+-Ta^{+3}, K^{+2}-Ru^{+5}, Ni^{+2}-Ru^{+5}, Al^+-Pd^{+4}, Fe^+-Ag^{+2}. The values deduced for the packing fractions of titanium, iron, and copper, and the probable values for zinc, silver, gold, and platinum are higher than those to be expected from Dr. Aston's packing fraction curve by about 2 parts in 10,000.

161. _____. Isotopic Constitution of Hafnium, Yttrium, Lutetium, and Tantalum. Phys. Rev., vol. 55, March 1939, pp. 794-795.

Hafnium ions were obtained from a high-frequency spark between nickel tubes packed with a mixture of lanthanum metal and hafnium oxide.

DENNISON, D. See abs. 182.

DERGE, G. See abs. 594.

DETWEILER, J. C. See abs. 102.

Generated on 2024-09-20 18:05 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

DeVRIES, T. See abs. 940.

162. DEWELL, E. H., AND VOIGT, A. F. Zirconium Ions in Aqueous Solution. Ames Lab., Iowa State College, ISC-146, June 15, 1951, 37 pp.

The ion exchange properties of zirconyl chloride have been studied in solutions 1.4 x 10^{-3} M in zirconium and 0.52 M in ammonium chloride; the cationic content of the solutions was found to vary from 99 percent to about 55 percent as upper limits in the acid range 1.62 x 10^{-2} M to 3.55 x 10^{-3} M. A time dependency of the exchange of zirconium was noted, and, in an attempt to discover its nature, conductance measurements at 10^{-4} M zirconium were made as time studies. Conductance curves were run at 25° and 35° C.; unfortunately they were not subject to analysis in terms of the probable species present. At least three conducting species were present in the solutions, and the measurements permitted the simultaneous observation of only two. The measurements are believed to be among the most accurate so far reported, and the concentrations investigated were much below the previous reports.

DeWITT, T. See abs. 196.

DIAMOND, H. See abs. 768.

DICKERSON, R. F. See abs. 764, 765.

163. DIGGES, T. G., AND REINHART, F. M. Influence of Nitrogen on the Hardenability and Notch Toughness of Boron-Treated Steels. Trans. Am. Soc. Metals, vol. 40, 1948, pp. 1124-1146.

End-quench and Charpy impact tests were made to determine the influence of nitrogen on the hardenability and notch toughness of boron-treated steels. Similar tests were carried out with high nitrogen steels containing about 0.0015 percent boron and varying amounts of titanium, chromium, or zirconium. Nitrogen had no significant effect on the hardenability of the steels without boron. Boron increased the hardenability of all the low nitrogen steels, but its presence was relatively ineffective in the high nitrogen steels that did not contain titanium or zirconium. Improvement in hardenability owing to boron, however, was attained in high-nitrogen steels by including enough of either titanium or zirconium. The notch toughness of the fully hardened and tempered steels was not materially affected by nitrogen or boron, whereas the notch toughness of the high nitrogen-boron steels containing titanium, chromium, or zirconium varied with the concentration of these elements, hardness and test temperature.

164. DILLING, E. D. Production of Zirconium. Bureau of Mines, 1953, 2 pp.

Zirconium, formerly considered a rare element, occurs in the earth's crust in greater concentrations than nickel, copper, lead, zinc, and several other familiar metals. Known reserves are found in many parts of the world including Idaho, Oregon, and California. The present production comes from Florida. At present, commercial zirconium tetrachloride is utilized as the starting material. Its flow through the process is shown in the attached plant flowsheet. Estimated capital expenditures on various sections of the plant are: Chemical purification, $920,000; direct chlorination, $176,000; and zirconium reduction plant, $802,000.

See also abs. 365, 366, 367, 807.

165. DiPIETRO, W. O., FINDLAY, G. H., AND MOORE, J. H. Preparation of Ductile Zirconium Final Report, December 30, 1948 - May 20, 1950. Nat. Research Corp., May 20, 1950, 94 pp. AECD-3276.

The progress made in the development of a continuous casting process for producing zirconium metal and an arc dissociation process for preparing zirconium from zirconium tetraiodide is described. It has been demonstrated that the continuous casting of zirconium rod appears

Generated on 2024-09-20 18:03 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

feasible over a range in pressure of 0.5 micron of Hg to an atmosphere with the proper power source and melting stock. An iodide preparation unit, with a potential batch capacity of 120 pounds of iodide, was developed and operated very satisfactorily. The arc dissociation of zirconium iodide has been accomplished, with conversions of 16.4 percent to 97.7 percent depending on conditions of operation, and a maximum yield of 255 grams per hour with an expenditure of 30 kilowatt hours per pound of metal. Neither phase has been carried to a point at which a decision on application to production can be made.

166. DODSON, D. A. Grain Refinement of Aluminum and Its Alloys. Canadian Metals, vol. 16, No. 8, July 1953, pp. 24-27.

A dense and fine grain structure in aluminum and its alloys is highly desirable and is recognized as giving many advantages. The author discusses the factors involved and the grain refining agents and practices that are used.

167. DOMAGALA, R. F., McPHERSON, D. J., AND HANSEN, M. System Zirconium-Chromium. Jour. Metals, vol. 5, No. 2, sec. 2, February 1953, pp. 279-283.

On the basis of metallographic analysis, incipient melting date, thermal analysis work, and X-ray diffraction phase relationships in the 0 to 50 atomic percent Cr region were carefully resolved. Phase relationships in the 50 to 100 atomic percent region were outlined. A single intermediate phase, $ZrCr_2$, was established in the system. A eutectic and a eutectoid were found in the zirconium-rich region of the system, whereas a eutectic was located in the chromium-rich region. Limited solubility of chromium in both α and β zirconium was observed.

168. _____. Systems Zirconium-Molybdenum and Zirconium-Wolfram. Jour. Metals, vol. 5, No. 1, sec. 1, January 1953, pp. 73-79.

On the basis of metallographic analysis, incipient melting data, thermal analysis work, and X-ray diffraction, phase relationships in the 0 to 50 atomic percent alloy content were carefully resolved. Phase relationships in the higher alloy content regions were outlined. A single intermediate phase, peritectically formed, of the form ZrX_2 was established in each system. A eutectic and a eutectoid were found in the zirconium-rich region of both systems. Appreciable solubility of molybdenum and wolfram was found in β zirconium, but only a slight solubility in α zirconium.

DONALDSON, V. V. See abs. 737.

DONEY, L. M. See abs. 31.

DOTY, A. S. See abs. 397.

169. DOW CHEMICAL COMPANY. Development of High-Temperature Magnesium Alloys With Specified Neutron Cross Section, Final Technical Report. July 19, 1951, 36 pp. NP-3535.

Mg-Th and Mg-Th-Zr alloys have been studied both in the sand-cast and in the extruded states over a wide composition range. The results clearly show that thorium contributes to magnesium the highest resistance to creep at elevated temperatures of any alloying element yet investigated. Although sand-cast binary Mg-Th alloys are seriously hampered by large grain size, this difficulty can be obviated by adding zirconium, which produces a grain size in the range of 0.001 to 0.003 in alloys containing as little as 1 percent Th. This, of course, increases markedly the strength properties at all temperatures and, contrary to our observations on Mg-rare earth alloy, the creep resistance at temperatures up to 600° F. is retained at a high level. Thus, in sand cast Mg-Th-Zr alloys we have the ideal combination of fine grain size, high strength and ductility, and high resistance to creep at temperatures up to 600° F. The alloy recommended for possible commercial development is Mg + 3Th + 1Zr. Both Mg-Th and Mg-Th-Zr alloys exhibit high creep resistance in the

Generated on 2024-09-20 18:01 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

extruded state. The zirconium-containing alloys are unusual in that the high-temperature creep resistance is essentially equivalent in the T5 and in the T6 conditions. Mg-Th-Zr alloys containing 1 to 6 percent thorium appear attractive as wrought high-temperature alloys inasmuch as they possess exceptionally high ductility and good strength at room temperature and high strength and creep resistance at elevated temperatures. For the best combination of properties they should be used in the T5 condition. Addition of pure cerium to Mg-Th and Mg-Th-Zr alloys effects small increases in strength but with a drastic decrease in ductility. Cerium is detrimental to the creep resistance of these alloys at 500° and 600° F. (Final Technical Report for Office of Naval Research on this project.)

170. DOW CHEMICAL COMPANY. Room and Elevated Temperature Properties of Powder Extruded Magnesium Alloys Containing Aluminum, Beryllium, and Zirconium, Quarterly Status Report, May 1 - August 1, 1950. August 1950, 7 pp. COO-16.

To date only creep tests at 200° and 300° F. on the following three compositions have been completed: KO, KO + 6A33 and KO + 12A33. No tension test results are available. The creep data are presented in the form of log stress vs. log extension. For each temperature, two curves are shown: One for creep extension and one for total extension, which is the sum of the creep extension and the loading extension. From these curves, three useful parameters, which adequately describe the creep resistance of an alloy, are derived: (1) Stress to produce 0.1 percent creep extension in 100 hr. (2) Stress to produce 0.1 percent total extension in 100 hr. (3) Stress to produce 0.5 percent total extension in 100 hr. Data for these tests are tabulated in the report. The data clearly show that addition of 6 percent A33 to KO enhances the creep resistance both at 200° and 300° F. Increasing the amount of A33 alloy to 12 percent produces a further gain in creep strength at 200° F. but has no effect on this property at 300° F. Tests will be continued on other compositions and at higher temperatures.

171. _____. Room and Elevated Temperature Properties of Powder Extruded Magnesium Alloys Containing Aluminum, Beryllium, and Zirconium, Quarterly Status Report, August 1 - November 1, 1950. November 1950, 12 pp. COO-20.

The high strength properties of extruded powder mixtures of KO alloy and aluminum or Mg-Al alloys have been confirmed. Furthermore, the high properties are enhanced by heat treating at 750° F. Data is tabulated in the report to illustrate the effect of various aluminum-containing additions on the properties of KO alloys. The properties of alloys decrease rapidly with increasing temperature of test but the aluminum-containing mixtures retain their superiority over KO. A homogenizing heat treatment applied to KO powder markedly lowers the strength properties of extruded mixtures made with KO so-treated. Results of a few creep tests on these alloys are presented in this report.

172. _____. Room and Elevated Temperature Properties of Powder Extruded Magnesium Alloys Containing Aluminum, Beryllium, and Zirconium, Quarterly Status Report, November 1, 1950 - February 1, 1951. COO-42, February 1951, 17 pp.

Tension tests at temperatures up to 600° F. on all KO + A33 extruded mixtures have been completed. Up to 300° F., addition of A33 to KO produces an increase in strength with increasing amount of added A33. At higher temperatures, however, there is no significant effect from such additions. Introduction of the aluminum into KO either as elemental aluminum or in the form of Mg-Al alloys more dilute than A33, produces essentially the same properties as A33. Although heat treatment of the KO powder at 1,050° F. before extrusion is detrimental to the room temperature properties of KO + A33 mixtures, the elevated

Generated on 2024-09-20 18:10 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

temperature strength properties of these mixtures are enhanced by such heat treatment applied to the KO before extrusion. Creep tests are proceeding on these alloys. More definite conclusions will be made when more of these tests are completed.

173. DOW CHEMICAL COMPANY. Room and Elevated Temperature Properties of Powder Extruded Magnesium Alloys Containing Aluminum, Beryllium, and Zirconium, Final Report, May 1, 1950 - April 30, 1951. COO-48, 58 pp.

Magnesium alloys containing up to 0.5 to 1.0 percent pure cerium offer the most promise for elevated-temperature applications of the Atomic Energy Commission where neutron capture cross-section is also an important limiting factor. Although powder-extruded magnesium-aluminum-zirconium alloys exhibit exceptionally high strengths at room temperature, their elevated-temperature properties, particularly creep resistance, are very low. Magnesium-zirconium-calcium alloys are definitely superior to magnesium-zirconium-aluminum alloys both in strength and creep resistance at moderately elevated temperatures; however, these alloys cannot compete with magnesium-cerium alloys in creep resistance. It is felt that the full benefits of calcium in magnesium-zirconium alloys have not been exploited fully. Further work in this alloy system is warranted.

174. DRAVNIEKS, A. Kinetics of the Zirconium-Nitrogen Reaction at High Temperatures, Technical Report No. 5, Reactions of Metals with Gases at High Temperatures. Illinois Inst. Technol., November 1949, 6 pp.

The kinetics of the zirconium-nitrogen-nitrogen reaction were studied between 862° to 1,043° C. The initial rate obeys the parabolic law with an activation energy of 52 kcal. and is independent of pressure. For reactions of long duration the rate increased compared to the initial parabolic rate, this change was probably due to volume changes of the metal phase.

175. _____. Oxidation of Several Metals in Activated Oxygen at High Temperatures. Jour. Am. Chem. Soc., vol. 72, August 1950, pp. 3761-3767.

Heretofore kinetic studies on the oxidation of metal surfaces have been restricted to the use of free oxygen, or some oxidizing compound such as water vapor, carbon dioxide, oxides of nitrogen, or ozone. Since it is well known that a properly regulated electric discharge can produce large quantities of oxygen atoms, it seemed worthwhile to ascertain experimentally the influence of such activated oxygen on the rate of oxidation of copper and other metals. The present paper reports a series of such measurements in the pressure range 0.5 to 2.0 mm. and at temperatures ranging from 500° to 690°.

See also abs. 141.

176. DRUYVESTEYN, M. J. Experiments on the Effect of Low Temperature on Some Plastic Properties of Metals. Appl. Sci. Research, vol. A-1, 1947, pp. 66-80.

The yield value, breaking strength, elongation, and hardness of a number of pure polycrystalline metals were measured at room temperature and at -183° C. The yield value is always higher at -183° C. than at 20° C., the difference being relatively small (<75 percent) for the cubic face-centered and a number of hexagonal metals (for example, Mg.). This difference is large for the body-centered metals and for Zn, Cd, and Sn. The former metals have a larger elongation at lower temperature, the latter, however, become more or less brittle at low temperature. The breaking strength and the hardness increase generally with decreasing temperature.

177. DUBE, H. L., AND PRAKASH, S. Kinetics of Sol-Gel Transformation, Part III, The Influence of Temperature on the Setting of Some Inorganic Jellies. Proc. Indian Acad. Sci. IIA, 1940, pp. 318-330.

Generated on 2024-09-20 18:04 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

In continuation with the previous work, the authors have studied the kinetics of sol-gel transformation with reference to the concentration of the coagulating electrolyte. Differently prepared samples of ferric phosphate show that in every case where a jelly is formed, the equation log S - log R + ρ log C is applicable during the period of slow gelation, where S is the rate of jelly formation, C the concentration of electrolyte, ρ the jelly-characteristic, and R the rate constant. The influence of temperature on the rate of setting of ferric arsenate, ferric phosphate, aluminum hydroxide, and zirconium hydroxide, and zirconium hydroxide jellies has been studied and it has been found that the value of R increases as the temperature is increased, whereas, the value of ρ shows only a very slight decrease. It is expected that so long as the jelly is not characteristically changed in texture, the value of ρ ought to remain constant, but in most cases, the texture also undergoes some variation as the temperature is increased (the jelly becomes opalescent and more synerising), the constant ρ slightly decreases.

178. DuBRIDGE, L. A., AND MARSHALL, Radioactive Isotopes of Sr, Y, and Zr. Phys. Rev., vol. 58, July 1, 1940, pp. 7-11.

Radioactive isotopes formed by bombardment of Rb, Sr, and Y by protons, deuterons, and neutrons are reported. The following are the periods and assignments: 2.75 hr. (Sr^{87}*e-, γ); 70-min. (Sr^{85}, e-, γ); 66-day (Sr^{85}, K, γ); 80-hr. (Y^{87},K); 14-hr. (Y^{87}, e-, γ); 105-day (Y^{86},K, γ); 4.5-min. (Zr^{89}, γ); 78-hr. (Zr^{89}, β+). (In each case e- means conversion electrons, not nuclear β-rays.) The electron spectrum of the 2.75-hr. Sr^{87}* shows a single line at 360 kev, and this period is shown to grow from the 80-hr. Y^{87} but not from the 14-hr. isomer.

179. DUCKWORTH, H. E., PRESTON, R. S., AND WOODCOCK, K. S. Masses of Si^{30}, Co^{59}, Ni^{60}, Zr^{90}, Mo^{96}, and Mo^{100}. Wesleyan University, Apr. 25, 1950, 3 pp. NYO-676.

The mass-spectrographic mass determinations recently reported have been extended to include Si^{30}, Ni^{60}, Zr^{90}, Mo^{96}, and Mo^{100}. From the mass of Ni^{60} that of Co^{59} may be deduced using disintegration data.

180. DUNKERLEY, F. J., PLEDGER, F., DAMIANO, V., AND FULTON, J. Grain-Growth and Recrystallization Characteristics of Zirconium. Jour. Metals, vol. 3, No. 11, November 1951, pp. 1003-1008.

Basic information needed as a guide in the hot and cold working and annealing of metals includes recrystallization and grain-growth data. A search of the literature revealed no such information for pure zirconium. This is a report of practical grain-growth and recrystallization results obtained for a commercial grade of pure zirconium on a project sponsored by the Office of Naval Research. In this work, isothermal grain-growth curves were obtained at 5 temperatures from 640° to 800° C. inclusively; whereas recrystallization curves have been determined at 450°, 500°, and 550° C. for the metal at the deformation levels of 20 and 50 percent. In addition to the usual variables of temperature, time, and deformation, distribution of the second phase found in all commercial grades of iodide zirconium is also treated as an important factor in these grain-growth and recyrstallization studies.

DUNLEAVY, R. A. See abs. 664.

DUNN, J. T. See abs. 891.

181. DURBIN, E. A., AND HARMAN, C. G. Appraisal of the Sintering Behavior and Thermal Expansion of Some Columbates. Battelle Mem. Inst., BMI-791, Dec. 15, 1952, 12 pp.

The mean coefficient of thermal expansion, for the range of 25° to 600° C., of Cb_2O_5, Ta_2O_5, $TiO_2.Cb_2O_5$, $Al_2O_3.Cb_2O_5$, and a solid solution of ZrO_2 + $3Cb_2O_5$

Generated on 2024-09-20 18:06 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

were 0.0, 1.5, 2.1, 2.9, and 0.9 x 10^{-6} per degree centigrade, respectively. The materials, when sintered in air at temperatures between 1,370° and 1,440° C., had low porosities and appeared to be stable in air, even at elevated temperatures.

182. DUSHMAN, S., DENNISON, D., AND REYNOLDS, N. B. Electron Emission and Diffusion Constants for Tungsten Filaments Containing Various Oxides. Phys. Rev., vol. 29, 1927, p. 903.

An abstract of a paper on work performed by the General Electric Co. on emission phenomena.

DUWELL, E. J. See abs. 32.

183. DUWEZ, P. Allotropic Transformation in Titanium-Zirconium Alloys. Jour. Inst. Metals, vol. 80, 1951-1952, pp. 525-527; California Inst. Technol., October 1951, 12 pp. NP-3490.

In titanium-zirconium alloys, the transformation from the high-temperature body-centered cubic β solid solution to the low-temperature hexagonal close-packed α solid solution is shown to take place, at least partly, at all compositions and at rates of cooling as high as 8,000° C./sec. This transformation is not complete, however, and the amount of the β solid solution that is retained is a maximum in alloys containing 50 at.-% of each metal.

184. DUWEZ, P., AND JORDAN, C. B. Structure of $ZrMo_2$. Jour. Am. Chem. Soc., vol. 73, No. 11, November 1951, p. 5509.

The existence of an intermediate phase in the zirconium-molybdenum system having the composition $ZrMo_3$ and the A15 (beta-wolfram) structure has been reported.

185. DUWEZ, P., AND ODELL, F. Phase Relationships in the System Zirconia-Ceria. Jour. Am. Ceram. Soc., vol. 33, No. 9, September 1950, pp. 274-283.

The phase relationships in the system zirconia-ceria were investigated by X-ray diffraction and dilatometric methods. The specimens were prepared by mixing and firing at 2,000° C. At 2,000° C. zirconia and ceria are miscible in each other from about 24 to 100 mole percent ceria. The range of solid solubility decreases markedly with temperature, so that near 1,000° C. the solubility of zirconia in ceria is only about 10 mole percent. The addition of 0 to 15 mole percent ceria lowers the temperature at which zirconia transforms from the tetragonal to the monoclinic form. Near 15 percent, therefore, this temperature is below room temperature and zirconia is stabilized. On the basis of these results, a tentative phase diagram of the system zirconia-ceria is presented. Experiments also have been conducted with zirconia containing 13.8 mole percent magnesia (stabilized zirconia). In this case, the solubility between stabilized zirconia and ceria is complete at high temperature (2,999° C.). At lower temperature, however, the solid solution breaks down and a two-phase region appears in the center of the diagram.

186. DUWEZ, P., ODELL, F. AND TAYLOR, J. L. Recrystallization of Beryllium Oxide Bodies at 2,000° C. Jour. Am. Ceram. Soc., vol. 32, No. 1, January 1949, pp. 1-9.

Recrystallization is an important factor in the preparation of very dense pure oxide ceramic bodies. The work described in this paper shows the effect of the original particle size on the degree of recrystallization of beryllium oxide bodies. Describes a water elutriator for particle-size separation on the subsieve range and on oxyacetylene furnace with zirconia refractories for operation at 2,000° C. The microscopic examination of prepared thin sections and the X-ray diffraction back-reflection method are used to determine particle sizes and the degree of recrystallization. Shrinkage during firing is found to be approximately constant for all particle sizes originally below 10 microns and decreases in a regular manner with

Generated on 2024-09-20 18:06 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

increasing particle size. The recrystallization factor for beryllium oxide is found to vary from 40 for 1.25-micron particles to 2.5 for 10-micron particles.

187. EASTMAN, E. D., BREWER, L., BROMLEY, L. A., GILLES, P. W., AND LOFGREN, N. L. Preparation and Properties of the Oxide-Sulfides of Cerium, Zirconium, Thorium, and Uranium. Jour. Am. Chem. Soc., vol. 73, August 1951, pp. 3896-3898.

The preparation, properties, and nomenclature for the oxide-sulfides of cerium, zirconium, thorium, and uranium are discussed. The compounds Ce_2O_2S, ThOS, UOS, and ZrOS have been prepared by the reaction of an oxide with sulfur or hydrogen sulfide. The crystal structures and lattice constants are given. The color, solubility, melting behavior, high temperature chemistry, and estimated thermochemistry are described.

EASTWOOD, L. W. See abs. 897.

EATON, R. B. See abs. 529.

EBERTS, W. U. See abs. 152.

188. EBORALL, M. D. Grain Refinement of Aluminum and Its Alloys by Small Additions of Other Elements. Jour. Inst. Metals, vol. 189, No. 441, December 1949, pp. 295-320.

The effect of eight elements on the grain-size of sand-cast pure aluminum and also that of titanium and boron on the grain-size of some aluminum alloys, has been studied. Several methods of adding titanium to the melts were used, and the efficiency of transfer of titanium was determined in each case. It was found that titanium, zirconium, and vanadium were the most effective grain refiners of pure aluminum, but that boron, although having little influence on the grain-size of pure aluminum, refined the grain of the copper-bearing alloys, its efficiency increasing with the copper content.

ECONOMOS, G. See abs. 484, 485.

189. EDWARDS, J. E., AND POOL, M. L. Characteristic X-rays Excited by Beta-Particles. Phys. Rev., 2d series, vol. 69, No. 11, 12, June 1-15, 1946, pp. 549-555.

Characteristic X-rays have been shown to be associated with a β-particle source. The X-rays excited in atoms outside the β-emitting atom were detected by absorption measurements and photographically with a curved crystal spectrograph. Characteristic Cu X-rays associated with the decay of 12.8-hour Cu^{64} are attributed to the strong beta-activity of the source. Photographs of characteristic X-rays excited by P^{32} β-particles in Cu, Zr, Rh, and Ag were obtained. The characteristic X-rays and general X-radiation excited by P^{32} β-particles in Al, Cu, Ag, Sn, and Pb were studied by absorption of the radiation in Al, Cu and Pb.

EECKHOUT, J. See abs. 254.

190. EGELSTAFF, P. A., AND TAYLOR, B. T. Slow Neutron Cross-Sections of Zirconium and Hafnium. Nature, vol. 167, June 2, 1951, pp. 896-897.

The total cross-sections of zirconia and hafnia have been measured between 0.05 e.v. and 10 e.v. using a crystal spectrometer and between 0.003 e.v. and 0.1 e.v. using a mechanical time-of-flight spectrometer.

EHRHARDT, C. H. See abs. 935.

191. EHRKE, L. F., AND SLACK, C. M. Investigation Into the Gettering Powers of Various Metals for the Gases Hydrogen, Oxygen, Nitrogen, Carbon Dioxide, and Air. Jour. Appl. Phys., vol. 11, February 1940, pp. 129-137.

Measurements of the gettering or clean-up ability of aluminum, magnesium, thorium, uranium, misch metal, zirconium, and barium for the common gases were made. In most cases the measurements were quantitative and represent gettering powers unassisted by an electric

Generated on 2024-09-20 18:06 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

discharge or other source of ions. The effect of temperature conditions on the gettering and keeping properties of several of the getters is given. The superior gettering powers of the diffuse layers produced by vaporizing the getters in the presence of a gas, as compared to those of the bright getter deposits produced in a high vacuum, were confirmed. Barium and misch metal were found to be the most active of the materials tried, and the convenient forms in which barium is now commercially obtainable would seem to make it first choice for most work, though it is not effective in the presence of Hg vapor. Thorium and uranium showed considerable activity for H_2 and O_2, but the high temperatures needed for flashing, make them rather inconvenient to use.

192. EISENSTEIN, A. S. Metallic Hydride Studies. Atomic Energy Comm., Dec. 7, 1945, 23 pp. NP-1917.

The first two parts of this report summarize recent measurements on the dissociation pressures of barium hydride and zirconium hydride. This work on zirconium and barium was carried out under DIC Project 4-6197, which also supported a literature survey covering the known metallic hydrides. The results of this extensive literature survey have been condensed into the table, including bibliography, which constitutes part III of this report.

See also abs. 789.

193. EL-BADRY, H., McDONNELL, F. R., AND WILSON, C. L. Inclusions of the Less Familiar Elements in a Small Scale Non-H_2S Scheme of Analysis. Anal. Chim. Acta, vol. 4, 1950, pp. 440-450.

A recognized non-H_2S scheme for separation and identification of the so called uncommon metallic elements has been extended so as to be applicable to materials containing the following elements: Cerium, molybdenum, thorium, titanium, tungsten, uranium, vanadium, and zirconium.

194. EMLEY, E. F. Nonmetallic Inclusions in Magnesium-Base Alloys Containing Zirconium. Jour. Inst. Metals, vol. 75, 1948-49, pp. 481-512.

The most effective grain-refining element for magnesium is zirconium, and this is conveniently introduced in the form of an alkali-metal chlorozirconate. Alloys so made are, however, contaminated with flux inclusions, which differ from normal types in that they are not removed by remelting. A study of these inclusions shows them to consist of the chloride products of the alloying reaction entrapped in clusters of insoluble zirconium-rich particles. These particles are formed through precipitation of dissolved zirconium by certain metallic impurities. Production of inclusions that are not removed on remelting appears to be a general phenomenon accompanying the introduction into molten magnesium of certain types of elements in the form of reducible chlorides. Attempts to avoid production of these inclusions and to eliminate them by fluxing, settling, and gauze-filtration methods have been unsuccessful, and it is concluded that zirconium-containing alloys made by alkali-metal chlorozirconates are inherently unreliable from the point of view of freedom from flux and unsuited to commercial development. Two other special types of flux contamination that are not removable by fluxing, settling, or gauze filtration can arise in zirconium-containing alloys by using the normal magnesium-base alloy fluxes. Oxide skins in molten alloys containing zirconium behave in the same way as in standard alloys (that is, pure magnesium and its commercial alloys containing aluminum, zinc, or manganese) but their speed of settling is slower, since they contain precipitated zirconium-rich particles. These particles render them readily detectable by radiography. Dispersed 'oxide' in zirconium-containing alloys is not removed by fluxes and may consist largely of ZrN.

Generated on 2024-09-20 18:06 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

195. EMLEY, E. F., JESSUP, A. C., AND HIGGINS, W. F. Effect of Phosphorus on the Corrosion-Resistance of Magnesium and Some of Its Alloys. Jour. Inst. Metals, vol. 80, September 1951, pp. 23-32.

Corrosion tests have been carried out, by total immersion in salt solution, on samples of magnesium alloys containing various amounts of phosphorus and other impurities. It is concluded that the corrosion-resistance of pure magnesium is reduced by the presence of phosphorus in amounts over about 0.002 percent, but that this effect can be suppressed by adding manganese. With a normal iron content, the adverse effect of phosphorus is not suppressed by manganese. Phosphorus also exerts a marked adverse effect on the corrosion resistance of high-purity Elecktron A8 (aluminum 8, zinc 0.4, manganese 0.25 percent, remainder magnesium). The amount of phosphorus that can be introduced into magnesium is much greater in the presence of iron. Phosphorus increases iron pickup in remelting A8 alloy. Phosphorus is precipitated from magnesium by zirconium, and the corrosion-resistance of alloys containing zirconium is unaffected by phosphorus present in the metal used for their preparation.

196. EMMETT, P. H., AND DeWITT, T. Determination of Surface Areas - Pigments, Carbon Blacks, Cement and Miscellaneous Finely Divided or Porous Materials. Ind. Eng. Chem., anal. ed., vol. 13, No. 1, Jan. 15, 1941, pp. 28-33.

This paper contains a summary of the results obtained on a series of carbon blacks, zinc oxide, pigments, titanium dioxide, barium sulfate, zirconium silicate, graphite, cement, lithopone, paper, and cuprene. The method for measuring surface areas of iron synthetic ammonia catalysts by means of low-temperature adsorption has been utilized in measuring surface area of a number of important finely divided materials.

ENGELKEMEIR, D. W. See abs. 73.

197. ENGINEER. American Application of the Ugine-Sejournet Extrusion Process. Nov. 21, 1952, pp. 680-683.

Although the conventional extrusion process for producing nonferrous tubes and solid shapes is now well established, it was the development of the Ugine-Sejournet process, using glass as a lubricant that has recently allowed hot extrusion to be applied to the production of stainless steels and highly alloyed refractory metals on an economical basis. This article outlines the history of the process and the applications it is finding in the United States and describes in detail the extrusion installation at the Tubular Products Division of the Babcock and Wilcox Co. in Beaver Falls, Pa.

ENTEMAN, C. See abs. 343, 800.

198. ESTERMANN, I., FRIEDBERG, S. A., AND GOLDMAN, J. E. Specific Heats of Several Metals Between 1.8° and 4.2° K. Phys. Rev., vol. 87, Aug. 15, 1952, pp. 582-588.

The specific heats of magnesium, titanium, zirconium, and chromium have been measured between 1.8° and 4.2° K. by the vacuum calorimeter method. In each case, it has been possible to represent the results by an expression containing an electronic term linear in the temperature and a lattice term cubic in the temperature. The electronic contribution to the specific heats of these metals is in reasonable agreement with expectations based on the Sommerfield theory and in particular, with the results of more recent detailed calculations of energy bands in transition metals. This work has been facilitated by development of a sensitive semiconducting resistance thermometer of germanium-indium alloy for use at liquid helium temperatures.

199. EUSNER, G. R., SCHOFIELD, H. Z., AND AUSTIN, C. R. Fundamental Studies of Ceramic Materials. Battelle Mem. Inst., Nov. 16, 1947, 11 pp. NP-1136.

Generated on 2024-09-20 18:21 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

This is the first of a series of progress reports covering studies being conducted on various ceramic materials, including zircons.

200. EVANS, G. E. Wanted: Better Materials for Nuclear Reactors. Iron Age, vol. 169, No. 11, March 1952, pp. 93-97.

Reactors resemble huge heat exchangers and materials must have satisfactory physical and thermal properties. Titanium, zirconium, and beryllium offer possibilities as construction materials. Bismuth, lead, sodium, and potassium could be used as liquid metal coolants. Ceramics and ceramic-metallics offer unusual mechanical properties at high temperatures. Several new alloys are suggested.

201. EVERHART, J. L. Hafnium Metal - Its Properties and Future. Materials and Methods, vol. 36, No. 5, November 1952, pp. 95-97; South African Min. Eng. Jour., vol. 64, No. 3144, May 16, 1953, p. 403.

A general survey is given of hafnium - occurrences, properties, metal-working, finishing treatment, welding, and uses.

202. _____. Titanium, Zirconium, Molybdenum, Tungsten, Tantalum, Columbium, Vanadium, Hafnium as Engineering Materials. Materials and Methods Manual 77, vol. 34, No. 6, December 1951, pp. 89-104.

These eight metals, which at first glance appear to be a heterogeneous group, have a number of attributes in common, including high melting points and sensitivity to gases. All can now be either hot or cold worked and have been developed to the point where they are now suitable for a wider range of uses. This manual discusses engineering properties, forming and machining characteristics, weldability, cleaning, and finishing characteristics, and present and potential uses.

203. EVERHART, J. L., AND VAN NUIS, E. L. Report From the Central Research Laboratory of the American Smelting and Refining Company. Am. Smelting and Refining Co., June 15, 1951, 25 pp. NYO-763.

This report summarizes the results obtained during an investigation of low-melting alloys containing bismuth, indium, lead, tin, and thallium. It is a continuation of work started under contract with the Office of Naval Research. Discusses investigation of the corrosion of a number of constructional materials by several of these alloys under unstressed static and dynamic conditions and an investigation of the effect of temperature on the viscosities of the low-melting alloys.

FAIRBAIRN, H. W. See abs. 437.

204. FAJANS, K. Electronic Structure of Some Molecules and Crystals. Ceram. Age, vol. 54, No. 5, November 1949, pp. 288-293.

A discussion of the electronic structure of some molecules and crystals is given from the standpoint of quanticule formulations, interpenetration and deformation of ions, cations with an 18-electron outer shell, coordination number, binding character, and electronic structure of carbides of group IV elements.

FALLON, W. A. See abs. 436.

FANEUFF, C. E. See abs. 562.

FARNHAM, G. S. See abs. 704.

FASSEL, V. A. See abs. 376.

205. FASSELL, W. M., JR. High Temperature Oxidation of Metals, Progress Report No. 2. University of Utah, Feb. 29, to June 1, 1952, 8 pp. NP-4245.

This report covers work on the high temperature oxidation of metals.

Generated on 2024-09-20 18:10 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Preliminary work on zirconium is complete and pressure experiments are in progress.

206. FASSELL, W. M., JR. High Temperature Oxidation of Metals, Progress Report No. 3. University of Utah, June 1 to Sept. 26, 1952, 10 pp. NP-4246.

This report covers work on the high-temperature oxidation of metals. Work is progressing on the oxidation. Oxidation rates on zirconium have been determined in the temperature range of 600° - 946° C. at 1 atmosphere pressure of oxygen. Research work is completed on tantalum, and results obtained are presented in Progress Report 2.

207. FAST, J. D. Allotropic Transformation of Hafnium and a Tentative Equilibrium Diagram of the System Zirconium-Hafnium. Jour. Appl. Phys., vol. 23, No. 3, March 1952, pp. 350-351.

The temperature of the transformation in hafnium is at least 550° C. higher than the value recently reported by Dumez. Gives a tentative equilibrium diagram of the system zirconium-hafnium.

208. _____. /Exceptionally High Solubility of Nitrogen and Oxygen in Some Metals, as Revealed in Studies of Zirconium and Titanium./ Metallwirtschaft, vol. 17, 1938, pp. 641-644.

Just as there are metals with an extraordinary great solubility of hydrogen (palladium, titanium, vanadium, etc.) there are also metals with abnormally high nitrogen and oxygen solubility. The harmful effect of these gases upon mechanical properties is very great in these cases. When insoluble nitrides or oxides are formed in these metals the harmful influence is much less. Titanium and zirconium are two such metals which possess very great solvent power for oxygen and nitrogen, whereas thorium belongs to the metals that form large amounts of oxides and nitrides insoluble in the metal. X-ray investigations showed a limit of the solubility of oxygen in zirconium with about 40 atomic percent and of nitrogen in zirconium about 20 atomic percent. The transformation of the hexagonal (alpha) through the cubical (beta) zirconium no longer takes place at a definite temperature (865 ± 10°) after the solution of oxygen, nitrogen, or both gases, but is spread over a temperature range the width of which depends upon the amount of gas in solution and is over 600° with 10 atomic percent of oxygen. After absorbing 10 atomic percent oxygen, the specific gravity of a zirconium rod increased from 6.54 to 6.60, which permits one to conclude that the oxygen atoms are located in the interstices of the metal lattice. In contradiction to hydrogen, oxygen, and nitrogen dissolved in zirconium and titanium, no longer can be driven out by heating in a high vacuum.

209. _____. /Mechanical Working of Zirconium and Titanium./ Metallwirtschaft, vol. 17, No. 17, 1938, pp. 459-462.

Zirconium and titanium are obtained in a brittle state because of the extremely high solubility of nitrogen, oxygen, and hydrogen in the solid state; in the case of oxygen in zirconium, for instance, this solubility is at least 40 atomic percent. Zirconium and titanium bars produced by the 'build-up' process entailing deposition by thermal evaporation, however, are completely ductile. Particulars are presented on the processing of these metals into sheet and wire, having for example a thickness of 30 microns (0.0012"), and on successful deep drawing experiments on zirconium sheet, also on the results of tensile tests, Erichsen cupping tests and measurements of the temperature coefficient of the electrical resistance. These measurements relate both to cold-worked zirconium sheet and wire and to such materials annealed to various temperatures subsequent to cold working. In conjunction with X-ray studies, these data give a good idea of the phenomena of cold work

Generated on 2024-09-20 18:09 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

elimination which manifest themselves during annealing.

210. FAST, J. D. /Transition Point Diagram of the Zirconium-Titanium System./ Rec. trav. chim., vol. 58, 1939, pp. 973-983. (Report, Chemical Works in the Low Countries.)

Titanium and zirconium both in their hexagonal and in their regular forms, form a continuous series of solid solutions with a transition point minimum for the atomic ratio 1:1. In this composition, transition from the hexagonal close-packed to the body-centred cubic modification takes place at 545° C., that is, at a temperature more than 300° C. below the transition temperatures of the pure components. The transition point of pure titanium was newly determined and found to be 885° ± 10° C. In the melting point diagram there is again a minimum which is probably located at the atomic ratio Ti : Zr - 2:1 and at a temperature of about 1,575° C.

See also abs. 89, 156, 157.

FAUST, C. L. See abs. 775, 776 777, 778.

211. FEHRER, H., AND TAYLOR, H. S. Two-Component Gel Catalysts Containing Chromium Oxide for the Aromatization of n-Heptane. Jour. Am. Chem. Soc., vol. 63, May 1941, pp. 1385-1386.

Various two-component gel catalysts containing chromium oxide have been studied for dehydrogenation-cyclization of heptane. Incorporation of the hydrogenating oxide catalysts, zinc, manganese, and molybdenum oxides produce catalysts that tend to favor low olefin content with a given production of aromatics. Incorporation of silica does not materially increase gel stability but produces greater availability of chromium oxide surface. Incorporation of zirconia and stannic oxide as promoters produces catalysts superior to standard gel owing to slower rate of poisoning. The catalysts are somewhat sensitive to the revivification procedure and lose activity. Zirconia itself had dehydrogenating-cyclizing activity toward paraffins at 475°.

212. FEIGL, F., AND BARBOSA, P. E. New Procedure for Detecting Acidity. Ind. Eng. Chem., anal. ed., vol. 14, No. 6, June 15, 1942, pp. 519-521.

Gives formulas, procedures, reagents, and applications for detecting acidity.

213. FELD, B. T., FESHBACH, H., GOLDBERGER, M. L., GOLDSTEIN, H., AND WEISSKOPF, V. F. Final Report of the Fast Neutron Data Project. Nuclear Development Assoc., Jan. 31, 1951, 244 pp. NYO-636.

Values for the neutron binding energies of Zr^{90} and Zr^{91} are given for the (γ,n) and (n,2n) reactions.

214. FELDMAN, C. Spectrochemical Determination of Hafnium-Zirconium Ratios. Oak Ridge Nat. Lab., Oct. 14, 1948, 19 pp. AECD-2342.

A spectrochemical technique is presented for determining hafnium-zirconium ratios in the range (Hf x 100)/Zr - 0.073-9.28, by weight, with and without the aid of hafnium-free zirconium preparations. The sample is brought into solution in 10 percent H_2SO_4 and sparked by the porous cup technique. The intensity ratio Hf 11 2641.406/Zr 11 2761.911 is measured and the Hf/Zr ratio read from a standard curve.

See also abs. 129.

FELLOWS, D. M. See abs. 657.

215. FERGUSON, J. D. Analysis of Ferrozirconium and Zirconium in Steel. Eng. Min. Jour., vol. 106, No. 8, 1918, p. 356.

Principal steps are given in the analytical determination of zirconium in steel.

Generated on 2024-09-20 18:07 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

FERNELIUS, W. C. See abs. 65, 521.

216. FERNELIUS, W. C., AND VONDRA, B. L., JR. Studies on the Preparation of Zirconium Tetraiodide. Pennsylvania State College, Dec. 8, 1949, 11 pp. NYOO-87.

Various methods for the conversion of zirconium materials likely to be obtained from a process for the separation of hafnium and zirconium into the metallurgically desirable zirconium tetraiodide have been investigated. Although some show promise, none are regarded as superior to the recently inaugurated commercial process involving the iodination of zirconium carbonitride.

FESHBACH, H. See abs. 213.

FINDLAY, G. H. See abs. 165.

217. FINK, W. L., AND WILEY, L. A. Equilibrium Relations in Aluminum-Zirconium Alloys of High Purity. Am. Inst. Min. Met. Eng. Tech. Pub. 1009, 1939, 12 pp.

This paper, the 20th of a series from the Aluminum Research Laboratories, reports the results of a recent investigation of equilibrium relations in aluminum-zirconium alloys of high purity.

FINKLE, B. See abs. 462, 463.

FISCHER, L. E. See abs. 441.

218. FISCHER, W., AND CHALYBAEUS, W. /Separation of Hafnium and Zirconium by Partition./ Dept. Comm. Office Tech. Services, PB L 19595, November 1944, 13 pp.

The rhodanide ether separation is recommended. Use of NH_4CNS + Zr-Hf sulfate solutions, treated with HCNS-ether, gives good results. The distribution coefficient α Hf and α Zr depends strongly on the temperature and concentration of the reagents, whereas the separation factor $\beta = \alpha$ Zr/ α Hf is not influenced, except by the concentration conditions favoring hydrolysis, reducing the efficiency. One can obtain conditions in which a 0.5 percent HfO_2 sample yields a concentrate with 5-10 percent HfO_2, with a 50 percent recovery in one extraction. Hf-rich materials behave similarly; with high Hf contents conditions are even more favorable. With subsequent ether extractions of a solution that has been extracted once before the efficiency decreases. Hf-rich solutions behave better in that regard.

219. FISCHER, W., CHALYBAEUS, W., AND ZUMBUSCH, M. /Separation of Inorganic Substance Mixtures by Distribution Between Two Solvents - Preparation of Pure Hafnium Compounds by Distribution./ Ztschr. anorg. Chem., vol. 255, 1948, pp. 277-286. NP-2099.

Translated by Gita Mazkevich for the Atomic Energy Commission - covering the fractional separation of zirconium-hafnium-thiocyanate mixture between water and ether, leads rapidly with good yields from initial materials poor in hafnium, through enriched products to hafnium preparations of a high degree of purity.

FISHER, H. See abs. 800.

FISCHLER, M. See abs. 800.

FISCHLER, M. C. See abs. 343.

220. FITZSIMMONS, E. S. Thermal Diffusivity of Refractory Oxides. Jour. Am. Ceram. Soc., vol. 33, No. 11, November 1950, pp. 327-332.

A method of measuring the thermal diffusivity of refractory materials is described. The experimental procedure is based on transient heat conditions requiring the measurement of only the time interval and the change in temperature. The results obtained for alumina, magnesia, zirconia, and alumina-clay specimens show the variation of diffusivity with temperature. Compares the results with those of previous studies.

FLEISHMAN, D. M. See abs. 674.

Generated on 2024-09-20 18:01 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

FLESHMAN, W. S. See abs. 14.

FLETCHER, H. G. See abs. 962.

221. FLETCHER, J. M. Chemical Problems Associated With Nuclear Reactors. Chem. and Ind., vol. 30, July 25, 1953, pp. 790-793. Lecture at Imperial College, London, Feb. 6, 1953.

The chemical problems related to the operation of nuclear reactors fall into three categories: (1) Production of materials for the reactor; (2) chemical reactions in the reactor; (3) processing of the reactor elements after removal from the reactor. This report deals with these particular problems.

FOGG, G. C. See abs. 733.

222. FONTANA, M. G. Corrosion. Ind. Eng. Chem., vol. 44, No. 7, July 1952, pp. 71A, 72A, 74.

Discusses corrosion resistance of tantalum, columbium (niobium), zirconium, tungsten, and molybdenum metals.

223. FORGENG, W. D. Color Metallography. Iron Age, vol. 162, No. 16, Oct. 14, 1948, pp. 130-133.

The use of color in metallography is particularly advantageous in alloys containing carbides, inclusions or sigma phase constituents, and grain size determinations not otherwise apparent by usual metallographic methods. These advantages are illustrated in this article, in which the author, employing nine different alloys, presents direct comparisons between black and white reproductions and color prints of identical structures. A description of the etching and photographic techniques required for optimum results is also included.

224. FORSLING, W. /Anion Exchange and Complex Formation of Hafnium in Hydrochloric and Hydrofluoric Acid Mixtures./ Arkiv Kemi, vol. 5, No. 45, Mar. 12, 1952, pp. 489-502.

The mechanism of anion exchange of the complex ions of hafnium formed in a low concentration range of hydrochloric and hydrofluoric acid mixtures is studied mainly by the use of the experimental data recently given by Huffman and Lilly. An interpretation of their data is proposed, which seems to explain quantitatively the dependence of the elution rate on the composition of the elutriant. As a result of this study, approximate values are obtained for the equilibrium constants for the formation of the hafnium fluorocomplexes present under the contitions used. For a correction of the experimental data, a short discussion of some methods for determining the fractional bed void space is included.

225. FOSTER, L. S. Electrochemical Production of Zirconium Powder. Metal Progress, vol. 62, No. 5, November 1952, pp. 178, 180.

Zirconium metal powder was produced by electrolysis of a fused sodium chloride-potassium hexafluozirconate (K_2ZrF_6) mixture, using a graphite crucible as anode and a graphite rod as cathode. Work is being continued to evaluate the effects of impurities and various types of treatments (cold working, annealing, hot working, and such) on the physical and mechanical properties of electrolytically produced zirconium.

226. _____. Preparation of Crucibles From Nitrides. Massachusetts Inst. Technol., July 1945, 60 pp. AECD-2942.

Methods developed for manufacturing TiN and ZrN consisted of first forming the corresponding hydride and then converting it to the nitride by reaction with ammonia. Crucibles were made by standard ceramic techniques and fired in high-temperature induction furnaces. Hydrostatic pressing gave crucibles with very low porosities. Boron nitride showed promise as a crucible material and as an insulating material for the construction of high-temperature furnaces. Iron

Generated on 2024-09-20 18:07 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

and cerium could be melted in nitride crucibles without appreciable contamination but beryllium could not.

227. FOSTER, W. R. Study of Solid-State Reaction in the Ternary System $MgO-ZrO_2-SiO_2$. Jour. Am. Ceram. Soc., vol. 34, No. 10, October 1951, pp. 302-305.

A study has been made of solid-state reaction at 1,450° C. in the ternary system $MgO-ZrO_2-SiO_2$. Approximately 40 selected compositions have been sintered to obtain essentially complete reaction. The calcines have been analyzed by X-ray diffraction methods, using a Norelco X-ray spectrometer. The solid-state compatibility relationships have been thereby established. The results are compared with those of some previous investigators. This study illustrates a general method of attack, which, although old in principle, has long been neglected. It is recommended that the method be revived by ceramists and others engaged in phase equilibrium research.

228. FOX, F. A. Development in Magnesium Alloys for Engineering Purposes. British Sci. News, vol. 3, 1950, pp. 126-128.

Zirconium has proved to be an economical and technically successful additive to magnesium and magnesium-zinc alloys. The new alloys are already finding many uses in the aircraft field. For example, the creep-resistant alloy containing cerium and zirconium is used for cast parts in many types of jet-engines and the magnesium-zinc-zirconium alloy for landing wheels for modern aeroplanes. The availability of these alloys should help appreciably in permitting the further engineering utilization of the useful characteristics of magnesium alloys.

See also abs. 948.

FRAAS, F. See abs. 149.

229. FRAAS, F., AND RALSTON, O. C. Electrostatic Separation of Several Industrial Minerals. Am. Inst. Min. Met. Eng. Tech. Pub. 2408, 1948, 11 pp.

Electrostatic methods of separation are used only when some peculiar advantage is gained. Such cases are minerals that are not separable by differences in specific gravity or magnetic response and that are desired in particles as large as 10-mesh, a size on which flotation separation is inefficient. This paper covers several separations of this type and others. It includes studies in the electrostatic behavior of kyanite, sillimanite and zircon, simple silicates that cannot be called either acid or basic but are more nearly neutral. Kyanite and sillimanite are both desired in 10-mesh size and are difficult to beneficiate from low-grade ores to give that type of concentrate. A separation of garnet from diopside was studied because this mixture had been removed from a wallastonite product by drying and magnetic separation. No special or extra preparation for electrostatic separation was necessary.

FRANCL, J. See abs. 657.

230. FRANCO, R. R., AND LOEWENSTEIN, W. Zirconium From the Region of Pocos de Caldas. Am. Mineral., vol. 33, 1948, pp. 142-151.

Zircon occurs as single crystals, in crystal groups, and in botryoidal intergrowths with fibrous, radial zirconium oxide in the region of Pocos de Caldas, Minas Gerais, Brazil. The forms noted are: p(111), a(100), m(110), and x(311). The amorphous zirconium oxide is believed to have been formed by precipitation from hot, ascending solutions that obtained their zirconium through the destruction of primary zirconium silicates (chiefly rosenbuschite, astrophyllite, and eudialyte). Much of the zircon appears to be later than the zirconium oxide and is believed to have resulted from the interaction of silica-bearing solutions with the oxide.

231. FREAR, D. E. H., AND SEIFERLE, E. J. Chemical Structure and Insecticidal

Generated on 2024-09-20 18:04 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Efficiency. Jour. Econ. Entom., vol. 40, 1947, pp. 736-741.

A total of 6,155 chemical compounds upon which insecticidal tests have been made has been collected from published and unpublished results. The constituent chemical groupings present in these compounds have been studied in relation to the results of the toxicity tests. It has been found that certain of these groups are regularly associated with high toxicity, whereas others are associated with low toxicity. The findings are presented as a guide for workers who are interested in the synthesis of compounds of insecticidal value. Zirconium and titanium are included among the inorganic cationic groups.

FRED, M. See abs. 434.

FREDERIC, G. L. See abs. 367.

232. FREE, O. Investigation of the Zirconium in Colorado Pitchblende. Phil. Mag., vol. 7, No. 1, 1926, pp. 950-960.

An examination of the pitchblende from Colorado has been made. The lead-uranium ratio was very small and indicates a maximum age of 2 million years. This establishes the recent formation of the mineral in contradiction to the other U. S. A. uraninites examined by Hillebrand and Boltwood. The identity of the constituent thought by Hillebrand to be zirconium has been confirmed, and no thorium or rare earths could be detected in the mineral. The chemical and radioactive analyses of the mineral gave 78.9 percent. U_3O_8, 5.25 percent. ZrO_2, with silica, pyrites, and moisture as the important constituents and traces of lead, titanium, and vanadium. A comparison of the density of the zirconia separated from large quantities of the mineral with specimens of zirconia separated from a blue Siamese zircon, reputed to be rich in hafnium and with a commercial zirconia preparation, showed that all these specimens were of similar low density and therefore of similar low hafnium content. In the spectra of the specimens from the pitchblende the scandium lines were very clearly shown.

FREUND, H. See abs. 949.

233. FREUND, H., AND MINER, F. J. Determination of Aluminum in Zirconium. Anal. Chem., vol. 25, No. 4, April 1953, pp. 564-567.

No entirely satisfactory method for determining small amounts of aluminum in zirconium has been available, owing to the lack of a suitable separation method. This paper describes an ion-exchange separation whereby the zirconium in a solution 0.06 M in hydrochloric acid and 0.8 M in hydrofluoric acid is exchanged on a column of Dowex-1, while the aluminum passes through the column. The aluminum may be determined in the eluate by conventional gravimetric or colorimetric procedures. Synthetic samples containing amounts of aluminum varying from 0.001 to 3.8 percent have been analyzed. As a consequence, a satisfactory method is now available for separating small amounts of aluminum in zirconium.

FREYER, R. H. See abs. 520.

FRID, B. I. See abs. 4.

FRIEDBERG, S. A. See abs. 198.

FRIEDLANDER, H. N. See abs. 803.

234. FROLICH, P. K., CARPENTER, G. B., AND KNOX, W. J., JR. Vapor Phase Esterification of Acetic Acid by Ethyl Alcohol. Jour. Am. Chem. Soc., vol. 52, 1930, pp. 1565-1570.

The vapor phase esterification of ethyl alcohol by acetic acid in the presence of a zirconium oxide catalyst has been studied over a temperature range of 250° to 300°. At 250° the reaction proceeded too slowly for equilibrium to be reached in the flow system employed. Above 300° there was a tendency for simultaneous dehydration of the alcohol into ethylene. In the absence of catalyst, no appreciable amount of ester was formed. Esterification

Generated on 2024-09-20 18:01 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

experiments with equimolar concentrations of ethyl alcohol and acetic acid gave 87.5 percent of ethyl acetate at 280°, corresponding to an equilibrium constant of 49.0. Hydrolysis of the ester by the reverse reaction gave a value of 49.3. In consideration of the possible error, the value of the equilibrium constant at this temperature may be taken as 49 ± 4. At 300° 88.8 percent conversion was obtained in esterification experiments but was not checked by the reverse reaction. This corresponds to an equilibrium constant of 63. Comparison of these results with others reported in the literature shows that the equilibrium constant changes only slightly with temperature. It may, therefore, be concluded that the maximum conversion to ester obtainable in this temperature range from equimolar concentrations of alcohol and acid is about 88 to 90 percent.

235. FRONDEL, C., AND COLLETTE, R. L. Synthesis of Zirconium, Thorium, and Uranium Silicates, Technical Report for July 1, 1952 to March 31, 1953. Harvard University, Mar. 30, 1953, 27 pp. RME-3048.

As mentioned in the First Quarterly Report, October 1952, experimentation on the ternary system $ZrSiO_4$-$ThSiO_4$-$USiO_4$ was begun during September 1952, the immediate objective of which was the synthesis and determination of the properties of the end members. Melt and bomb furnaces have been constructed, hydrothermal bombs designed, constructed and tested, designs of temperature regulators for the specific problem tested, and pressure reading and controlling equipment ordered. The end members, $ZrSiO_4$ and $ThSiO_4$, have been synthesized. However, $USiO_4$ has not been synthesized. The present objectives are synthesis of the latter member, coarse crystalline growth of the other two, the synthesis and X-ray identification of intermediate compounds in the bulk state. Also gives a proposed program for the continuation of this work.

FULMER, E. I. See abs. 848.

FULTON, J. See abs. 180.

236. FURMAN, N. H., MASON, W. B., AND PEKOLA, J. S. Extraction of Cupferrates. Anal. Chem., vol. 21, No. 11, November 1949, pp. 1325-1330.

The theory of the extraction of cupferrates is presented, together with certain simplified theoretical relationships. The properties of various cupferrates are reviewed briefly. Some experimental data are given on the extraction of various cupferrates including zirconium cupferrate as a function of acidity and excess of cupferron. Some advantages of the extraction procedure as contrasted with the precipitation techniques in cupferron separations are pointed out.

237. GABLE, H. S. Metallic Precipitation of Zirconium. Jour. Am. Chem. Soc., vol. 52, September 1930, p. 3741.

Discusses a possible method by which zirconium may be precipitated from solutions other than aqueous. Gives results and reactions.

238. _____. Zirconium. II. Zirconium Oxalate and Diphenyldinitrogen Zirconium. Jour. Am. Chem. Soc., vol. 53, April 1931, pp. 1276-1278.

The use of methyl alcoholic solutions allows compounds of zirconium to be prepared without danger of hydrolysis. The normal zirconium oxalate, $Zr(C_2O_4)_2$, was prepared and described. Diphenyldinitrogen zirconium, $(C_6H_5N)_2Zr$, was prepared and described.

239. _____. Zirconium. III. The Reaction Between Ammonia and Methyl Alcoholic Solutions of Zirconium Sulfate. Jour. Am. Chem. Soc., vol. 53, 1931, pp. 1612-1614.

The fact that solutions of zirconium salts yield upon adding ammonium hydroxide a white gelatinous precipitate of zirconium hydroxide quite insoluble in water or in an excess of the precipitant

Generated on 2024-09-20 18:12 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

has been known since the days of Berzelius. The results of recent work in this laboratory tend to show, however, that under special conditions a compound other than the hydroxide may be precipitated by ammonium hydroxide if the zirconium sulfate be dissolved in methyl alcohol.

GABRIEL, A. See abs. 149.

240. GAD, G. M. Zircon Refractories. Refractories Jour., vol. 28, November 1952, pp. 485-490.

Zircon briquettes made from Rashid zircon, Egypt, of 45 : 10 : 45 gradings, pressed at 2 tons/inch and fired at 1,450° or 1,500° C. showed low porosities, high crushing strength and high resistance to subsidence under load at high temperatures. Briquettes of the 45 : 10 : 45 gradings, molded by hand and fired at 1,450° C., showed reasonable porosities, good crushing strength, and good resistance to subsidence-under-load at high temperatures.

GALE, R. H. See abs. 320.

241. GAMBLE, L. W. Spectrographic Analyses of Cracking Catalysts Determination of Magnesium and Zirconium. Anal. Chem., vol. 23, No. 12, December 1951, pp. 1817-1820.

The need for rapid methods for determining magnesium and zirconium in connection with catalyst development problems led to the study of spectrographic procedures. Internal standards, copper for determination of magnesium and cobalt for determination of zirconium were employed with direct current excitation. The method for magnesium has been applied to samples containing from 0.2 to 10.0 percent magnesia, while the zirconium method is useful in the range of 0.01 to 5 percent zirconium oxide. The results obtained by the spectrographic methods are in fair agreement with those obtained by using chemical methods. Discusses the effect of large amounts of alumina on the determination of zirconium. Both methods are applicable to the analysis of clays.

GAMMILL, A. M. See abs. 522, 523.

GANGLER, J. J. See abs. 408.

GATES, R. W. See abs. 15.

242. GAYLER, R., AND PRATT, H. R. Liquid-Liquid Extraction, Part V: Further Studies of Droplet Behavior in Packed Columns. Atomic Energy Research Est., AERE CE/R-904, England 1953, 15 pp.

Mean droplet sizes have been determined for the system ethyl acetate-water with 1/2 inch Raschig rings using a procedure described in an earlier paper. The results deviate somewhat from the earlier correlation and the following modified expression, which accounts more satisfactorily for the effect of the phase flow rates, is suggested as an alternative:-

$$\frac{d_{vs}\,\Delta\rho\gamma}{\mu_c^2} = 1.42\,\frac{(\Delta\rho\gamma^3)}{(\mu_c^4 g)}^{0.475}\,\frac{(v\,\rho\epsilon\,x)}{(V_d)}$$

where $\bar{v}_o$. is the 'characteristic velocity'. Further droplet size determinations have also been carried out for the system methyl 1-butyl ketone-water owing to doubts about earlier results. The new data are in good agreement with the above expression. The effects of incomplete mutual saturation of the phases and of the presence of an unequilibrated solute also have been investigated. It was found that the mean droplet size is increased in the former case, and also in the latter case when the solute is present in the dispersed (solvent) phase. When it is present in the continuous phase, or is brought to equilibrium between the phases the droplet size is normal. The effect of these results on the design of packed extraction columns is discussed briefly.

GEE, E. A. See abs. 929.

243. GEE, E. A., GOLDEN, L. B., AND LUSBY, W. E., JR. Titanium and Zirconium Corrosion Studies, Common Mineral Acids. Ind. Eng. Chem., vol. 41, No. 8, August 1949, pp. 1668-1673.

Generated on 2024-09-20 18:11 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Titanium is resistant to sulfuric and hydrochloric acids only at low concentrations but is almost completely resistant to all concentrations of nitric acid. As a corrosion resistant metal in hydrochloric and nitric acids, its general behavior is comparable to Type 316 stainless steel. However, it is somewhat less resistant than the latter in sulfuric acid. Zirconium is relatively resistant to all concentrations of hydrochloric, nitric, and phosphoric acids, although it is attacked by high concentrations of sulfuric acid at elevated temperatures.

GEIL, G. W. See abs. 578.

244 GEIST, H. H., AND CHANDLEE, G. C. Determination of Zirconium in Steels With n-Propylarsonic Acid. Ind. Eng. Chem., anal. ed., vol. 9, No. 4, 1937, pp. 169-170.

Zirconium can be determined in steels with n-propylarsonic when present in amounts as low as 0.1 percent and in the presence of titanium, aluminum, chromium, cobalt, nickel, copper, uranium, vanadium, thorium, molybdenum, and tungsten. Tin is partly precipitated by this reagent, but the zirconium dioxide residues obtained upon ignition may be freed from tin oxide by adding powdered ammonium iodide and igniting.

GELLER, R. F. See abs. 86, 519.

245. GELLER, R. F., AND YAVORSKY, P. J. Effects of Some Oxide Additions on the Thermal Length Changes of Zirconia. Nat. Bureau of Standards, Research Jour., vol. 35, July 1945, pp. 87-110.

The oxides of cerium, yttrium, silicon, magnesium, and calcium were added in various proportions to zirconia of 99 percent purity, and the effects of these additions, combined with preheating at various temperatures ranging from 1,450° to 1,950° C., on thermal length changes of the zirconia during heating and cooling between room temperature and a maximum of 1,700° C. were observed. The results are compared with similar observations on zirconia of 96, 98, and 99 percent purity without oxide additions. The results show that the irregular thermal length changes accompanying phase transformations in zirconia may be prevented by changing the crystal to the stable cubic form. This was accomplished by (1) 11.5 and 15 percent additions of Y_2O_3 and heating at 1,700° C. or higher; (2) 8 and 15 percent additions of MgO and heating at 1,550° C. or higher, but only for the range from room temperature to 1,200° C.; and (3) 5, 6, 8, and 15 percent additions of CaO and heating at 1,550° C. or higher, but additions of more than 6 percent caused the specimens to be very porous and proportionately weak. In all cases, however, the expansion during heating and contraction during cooling was relatively high. The coefficients of linear thermal expansion of the specimens that were all, or nearly all, cubic ranged from 8.8 to 11.8×10^{-6}. Also, zirconia has a low thermal conductivity relative to such materials of high thermal expansion as alumina, magnesia, and beryllia (unpublished data). Consequently, a high resistance to thermal shock cannot be expected of the stabilized product, even though it is not subject to the structural disintegration characteristic of the commercially pure material.

246. GELLER, R. F., YAVORSKY, P. J., STEIERMAN, B. L., AND CREAMER, A. S. Studies of Binary and Ternary Combinations of Magnesia, Calcia, Baria, Beryllia, Alumina, Thoria, and Zirconia in Relation to Their Use as Porcelains. Nat. Bureau of Standards, Research Jour. RP1703, vol. 36, March 1946, pp. 277-312.

Specimens formed by pressing were heated and tested for absorption and shrinkage to determine the vitrification range. These pressed specimens represented the various oxides in simple binary and ternary combinations and also with minor additions of auxiliary oxides. Vitrified pieces were tested for strength in compression, thermal conduction and expansion electrical resistance,

Generated on 2024-09-20 18:21 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

dielectric properties, water solubility, and resistance to attack by PbO liquid and vapor. Several compositions of unusual and valuable properties were disclosed. Phase relations were approximated by fusion tests and petrographic examinations of nonquenched samples.

247. GELLER, S., AND CORENZWIT, E. Hafnium Oxide HfO_2 (Monoclinic). Anal. Chem., vol. 25, No. 11, November 1953, p. 1774.

A table on X-ray powder diffraction data for monoclinic hafnium oxide.

248. GERASSIMOVSKY, V. I. /On the Role of Zirconium in Minerals of Nepheline-syenite Massifs./ Compt. rend. acad. sci. U. R. S. S., vol. 30, No. 9, 1941, pp. 820-821.

Zirconium (an amphoteric element) in nepheline-syenites performs different functions according to conditions available. In a more acid environment (or in the presence of surplus of alkalies) it appears as cation and forms zircon ($ZrSiO_4$); in a less acid environment, together with silicon, it plays the role of a complex anion in eudialite, eucolite, and other complex zirconosilicates.

GERDS, A. V. See abs. 72.

249. GEST, H., BURGUS, W. H., AND DAVIES, T. H. Coseparation of Aqueous Fluozirconate Ion With Solid Lanthanum Fluoride, chap. in Radiochem. Studies: The Fission Products, Nat. Nuclear Energy Series. McGraw-Hill Book Co., Inc., book 1, vol. 9, No. 2, New York, N. Y., 1951, pp. 157-169.

Using Zr^{95} as a radioactive indicator, surface absorption was found to be primarily responsible for the coseparation of zirconium with both (1) externally formed and (2) internally formed LaF_3 in 1M HNO_3 and 0.5 M HF. The Langmuir adsorption equation, $X/m = k_1c/(1 + k_2c)$, described the data satisfactorily where in (1) $k_1 = 0.05$ and $K_2 = 2.3$ and in (2) $k_1 = 0.053$ and $K_2 = 0.71$. The adsorption was found to be reversible, to be independent of the concentration of HF from 0.1M to 1.0M and of HNO_3 from 0.3M to 1.0M, and to be unaffected by temperature from 27° to 70° C. It was possible to calculate a specific surface of 58.3 square meters per gram for the externally formed LaF_3 from the observed saturation adsorption of 14.6×10^{19} fluozirconate ions per gram. This value compared favorably with that determined by the adsorption of nitrogen.

250. GEST, H., AND GLENDENIN, L. E. Coseparation of Aqueous Fission Products With Manganese Dioxide, chap. in Radiochem. Studies: The Fission Products, Nat. Nuclear Energy Series. McGraw-Hill Book Co., Inc., book 1, vol. 9, No. 2, New York, N. Y., 1951, pp. 170-175.

The coseparation of mixed fission products with internally and externally formed MnO_2 precipitates was examined. In dil. HNO_3, niobium, tellurium, zirconium, and possibly other elements are carried. In more concentrated HNO_3 (above 10M, columbium (niobium), tellurium, and molybdenum are carried well. The coseparation of Nb^{95} with externally formed, freshly precipitated, wet MnO_2 in 10M HNO_3 (MnO_2 concentration of approximately 0.6 gm/liter at 70° C.) is quantitative after 30 min. of contact. Dry reagent-grade MnO_2 is less effective. In 1M HNO_3 at 70° C., MnO_2 causes a partial separation of the Te^{129} isomeric pair, the newly formed 72m isomer being preferentially removed by the oxide.

251. GIBBS, R. C., AND WHITE, H. E. Certain Multiplets in the Spectra of Cb III and Cb IV. Phys. Rev., vol. 31, April 1928, pp. 520-526.

Relative positions of certain multiplets in two and three electron systems of the second long period with wavelengths for Zr III, Cb IV, and Cb III. Applying the irregular doublet law to the data already known for the triad of multiplets ^3DF, $^3DD^3$, and ^3DP, (ds-dp)

Generated on 2024-09-20 18:03 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

in the two electron systems of Sr I and Yt II, the corresponding multiplets for Zr III and Cb IV have been identified. Similarly the triad of multiplets $^4F^3D^3$, $^4F^3F$ and $^4F^3G^3$ ($d^2d\text{-}d^2p$) in the three electron systems of Yt I and Zr II has been extended to Cb III and the stronger lines of the $^4F^3G^3$ multiplet of Mo IV. In passing successively from element to element in both of these isoelectronic systems the shift in the frequency of the radiated lines for each of these multiplets is approximately constant.

GILBERT, H. L. See abs. 503, 505, 864, 865.

252. GILBERT, H. L., ASCHOFF, W. A., AND BRENNAN, W. E. Arc Melting of Zirconium Metal. Jour. Electrochem. Soc., vol. 99, No. 5, May 1952, pp. 191-193.

In arc-melting zirconium metal with a tungsten electrode, tungsten appears in nonuniform amounts throughout the ingot. To eliminate this, the use of consumable electrodes of zirconium sponge is proposed. All early attempts to use sponge zirconium electrodes were unsuccessful owing to instability of the arc. This problem was solved by stabilizing the arc with a small amount of magnesium metal added to the zirconium sponge used in making up the electrodes. A water-cooled copper sleeve was used as a melting section in the arc-melting furnace. Melting was done under an inert atmosphere of argon or helium. Metallographic and radiographic studies show the finished ingots to be sound.

253. GILBERT, H. L., AND MORTIMORE, D. M. Empirical Study of Kroll Process Zirconium. Bureau of Mines, undated, 16 pp.

Data are given from tests of the thermal expansion at the critical point, thermal analysis, fatigue, tensile strength, impact strength, annealing, and quench hardening of Kroll process zirconium.

GILBERT, N. See abs. 695.

GILCHRIST, R. See abs. 118.

GILLES, P. W. See abs. 187.

GILLESPIE, J. See abs. 129.

254. GILLIS, J. AND BECKHOUT, J. Quantitative Spectrochemical Spectrochemical Analysis of Steel. Anal. Chim. Acta, vol. 1, February 1947, pp. 377-389.

Describes operating conditions for the spectrochemical analysis of iron and C-steel using solutions. These invariably furnish a better average sample than if solid electrodes are employed. Solutions are, moreover, always homogeneous and the most widely different material, of any shape, as well as the finished products can always be investigated under the same conditions. The technique described is based on Scheibe and Riva's method. As a light-source, however, the Pfeil-Sticker interrupted a.c. arc was used. The whole of the investigation was carried out with a Hilger medium spectrograph. The results are very satisfactory and prove that an apparatus of moderate dispersion can also serve very well for the spectrochemical analysis of steel. Analysis-lines and standardizing tables are given for the determination of the contents of Ni, Mn, Cr, Co, Ti, Al, Mo, V, Zr, As, Cu, Cb, and Ta in pure iron or C-steel.

255. GILLSON, J. L. Deposits of Heavy Minerals on the Brazilian Coast. Min. Eng., vol. 187, June 1950, pp. 685-693.

Brazil has had an industry based on ocean beach deposits of heavy minerals containing monazite, zircon, rutile, and ilmenite for well over 40 years, but except at the very earliest period, before 1906 and again during World War II, has this industry been at all comparable in size with similar operations in other countries. Limiting factors have been neither a lack of reserves nor lack of markets (except of zircon). Although poor local transportation and shipping facilities have handicapped the

Generated on 2024-09-20 18:55 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

development in Brazil, these conditions were perhaps equally bad (when mining operations started) in the Indian State of Travancore and in New South Wales and Queensland, Australia, in which states the principal production of beach deposits of heavy minerals has occurred. The outstanding restraints on the Brazilian industry have been the lower quality of the Brazilian minerals, the relative small size of individual deposits that were known until recently, the lack of interest of Brazilian investors in mining ventures, and the unfavorable climate for investment of foreign capital under Brazilian mining law. Types and locations of deposits are discussed as well as the problems of recovery.

See also abs. 102.

GITMAN, E. B. See abs. 693.

256. GLASER, F. W. Pressure Sintering of Pure (Uncemented) Zirconium Boride at Temperatures Above 2,500° C. Powder Met. Bull. vol. 6, No. 1, April 1951, pp. 51-54.

This study was initiated as an approach to determining the electrical resistivity of the sintered compound zirconium boride. A room temperature value of 9.2 microhm-cm. has previously been reported for this material by Moers. Electrical resistivity measurements carried out by Friederich and Sittig on sintered zirconium boride compacts are only qualitatively comparable with the results obtained by Moers on wire samples, since the Friederich and Sittig data was obtained by Moers on low-density specimens and therefore cannot be considered as the true value of electrical resistivity for the compound ZrB_2. Similarly, Norton, Blumenthal, and Sindeband reported the value of 38.8 microhm-cm. for a hot pressed and approximately 75 percent dense ZrB_2 specimen.

See also abs. 702.

257. GLASSNER, A. Survey of the Free Energies of Formation of the Fluorides, Chlorides, and Oxides of the Elements to 2,500° K. Argonne Nat. Lab., ANL-5107, August 1953, 40 pp.

Free energy calculations are given in table and graphic form.

258. GLENDENIN, L. E. Determination of Niobium Activity in Fission, chap. in Radiochem. Studies: The Fission Products, Nat. Nuclear Energy Series. McGraw-Hill Book Co., Inc., book 3, vol. 9, No. 6, New York, N. Y., 1951, pp. 1523-1528.

The standard oxalate-chloric acid procedure for columbium (niobium) does not separate columbium satisfactorily from zirconium in phosphate solution, and a simple modification has been devised based on the removal of zirconium by the precipitation of $BaZrF_6$. The separation of columbium from the other fission activities, including zirconium, is shown to be satisfactory by tracer tests. Tellurium is carried through the procedure to the extent of a few percent but does not contribute significantly to γ-activity measurements.

259. GMELIN, LEOPOLD. (Hafnium, System No. 43); chap. in /Gmelin's Handbook of Inorganic Chemistry/. Chemical Publishing House, Ltd., Berlin, 8th ed., rev. 1941, 82 pp.

Covers the chemistry of hafnium, system number 43.

260. GODLEY, P. Metal Coatings by High Vacuum Evaporation. Iron Age, vol. 161, No. 14, Apr. 1, 1948, pp. 90-94.

Use of high-vacuum techniques for applying thin metallic coatings to metal and nonmetal surfaces holds promise of developing into an important industrial tool. This article discusses briefly some of the fundamental aspects of evaporated coatings, describes units for both continuous and batch type work. The author also comments on the physical characteristics of such coatings and lists some interesting applications of this technique, including the coating

Generated on 2024-09-20 18:01 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

of thin plastic sheeting and condenser paper.

GOLDBERGER, M. L. See abs. 213.

261. GOLDEN, L. B. Corrosion Resistance of Zirconium and Its Alloys; chap. in Zirconium and Zirconium Alloys, Am. Soc. Metals, Cleveland, Ohio, 1953, pp. 305-326.

Outstanding resistance to corrosion is one of the most attractive properties of zirconium. The possibility of using this metal and certain of its alloys in chemical industry where severe corrosion problems arise prompted this investigation. Induction-melted zirconium, in general, shows excellent resistance to all but the highest concentrations of the mineral acids. It is almost completely resistant to attack by organic acids and by inorganic chloride solutions. A notable exception is the embrittlement type of attack suffered by zirconium in ferric and cupric chloride solutions. Arc-melted zirconium is almost completely resistant to concentrated hydrochloric acid under pressure at elevated temperatures but induction-melted metal is severely embrittled. A number of arc-melted binary zirconium alloys are almost equal to the pure metal under identical test conditions. Titanium-zirconium alloys are far superior in corrosion resistance to unalloyed titanium. From the results presented, zirconium and some zirconium alloys undoubtedly will be used in many applications where excellent resistance to severe corrosive conditions is mandatory.

See also abs. 243.

262. GOLDEN, L. B., LANE, I. R., JR., AND ACHERMAN, W. L. Embrittlement of Zirconium and Tantalum in Hydrochloric Acid. Ind. Eng. Chem., vol. 45, No. 4, April 1953, pp. 782-787.

Corrosion rates for ordinary purity zirconium induction-melted in graphite were determined in various concentrations of nonaerated and static hydrochloric acid at atmospheric pressure. Embrittlement occurred in one lot of the metal in a 6-day test in concentrated (37 percent) hydrochloric acid, but not in a second lot exposed for 30 days. This has been attributed to differences in the purity of the separate lots of metal. Samples of high-purity arc-melted metal were almost completely resistant under these conditions. High-purity zirconium induction-melted in graphite was evenly etched but showed no signs of embrittlement. Arc-melted zirconium and some zirconium alloys may serve as well as tantalum in industrial applications requiring resistance to the corrosive action of hydrochloric acid, provided, of course that contaminants are absent or additions of certain chemicals such as ferric chloride have not been made.

263. _____. Corrosion Resistance of Titanium, Zirconium, and Stainless Steel. Ind. Eng. Chem., vol. 44, No. 8, August 1952, pp. 1930-1939.

The severe corrosion problems arising in chemical industry wherever mineral acids and metal chlorides are encountered prompted the investigation of titanium and zirconium as possible materials of construction for service in these mediums. These metals, along with a 20-29 chromium-nickel-type stainless steel, show excellent resistance to all concentrations of nitric acid. In mixed acid solutions both titanium and stainless steel have better corrosion resistance than zirconium. Of these three materials, only zirconium is fully resistant to corrosion in hydrochloric acid solutions. Titanium is fully resistant to an atmosphere of water-saturated chlorine, whereas zirconium and stainless steel are severely attacked. Heavy metal chloride solutions have negligible effect on titanium, whereas stainless steel is badly pitted and perforated. Zirconium is embrittled by ferric and cupric chloride solutions but unaffected by mercuric chloride. Titanium and zirconium are fully resistant to corrosion by solutions of alkali and alkaline earth chlorides, whereas stainless steel is susceptible to pitting in these

Generated on 2024-09-20 18:05 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

mediums. Titanium is entirely unaffected by hypochlorite solutions, zirconium is slightly embrittled, and stainless steel is badly pitted.

264. GOLDEN, L. B., LANE, I. R., JR., AND MACE, W. Corrosion Studies on Titanium and Zirconium Metals. Semi-Annual Rept., December 1949, Bureau of Mines, 1949, 15 pp.

An investigation was initiated in June 1947 to obtain quantitative data on the corrosion resistance of titanium and zirconium metals and their alloys to acids, bases, salts, and various organic compounds. A series of reports have been issued periodically covering progress made.

265. GOLDEN, L. B., LANE, I. R., JR., RHODERICK, E. V., ACKERMAN, W. R., AND MACE, W. Corrosion Studies on Titanium and Zirconium Metals. Semi-Annual Rept., January-June 1950, Bureau of Mines, 1950, 19 pp.

266. GOLDEN, L. B., LANE, I. R., JR., ACKERMAN, W. R., PONS, J. T., AND MACE, W. Corrosion Studies on Titanium and Zirconium Metals. Monthly Rept. for July 1950, Bureau of Mines, 1950, 10 pp.

267. GOLDEN, L. B., LANE, I. R., JR., ACHERMAN, W. R., PONS, J. T., AND MACE, W. Corrosion Studies on Titanium and Zirconium Metals. Monthly Rept. for August 1950, Bureau of Mines, 1950, 6 pp.

268. GOLDEN, L. B., LANE, I. R., JR., RHODERICK, E. V., PONS, J. T., ACHERMAN, W. R., AND MACE, W. Corrosion Studies on Titanium and Zirconium Metals. Monthly Rept. for September 1950, Bureau of Mines, 1950, 5 pp.

269. GOLDEN, L. B., LANE, I. R., JR., RHODERICK, E. V., PONS, J. T., AND MACE, W. Corrosion Studies on Titanium and Zirconium Metals. Monthly Rept. for October 1950, Bureau of Mines, 1950, 6 pp.

270. GOLDEN, L. B., LANE, I. R., JR., RHODERICK, E. V., PONS, J. T., ACHERMAN, W. R., AND MACE, W. Corrosion Studies on Titanium and Zirconium Metals. Monthly Rept. for November 1950, Bureau of Mines, 1950, 3 pp.

271. _____. Corrosion Studies on Titanium and Zirconium Metals. Semi-Annual Rept., December 1950, Bureau of Mines, 1950, 27 pp. AECU-1299.

272. _____. Corrosion Studies on Titanium and Zirconium Metals. Monthly Rept. for January 1951. Bureau of Mines, 1951, 8 pp.

273. _____. Corrosion Studies on Titanium and Zirconium Metals. Monthly Rept. for February 1951, Bureau of Mines, 1951, 11 pp.

274. GOLDEN, L. B., LANE, I. R., JR., PONS, J. T., MACE, W., AND ACHERMAN, W. R. Corrosion Studies on Titanium and Zirconium Metals. Monthly Rept. for March 1951, Bureau of Mines, 1951, 10 pp.

275. _____. Corrosion Studies on Titanium and Zirconium Metals. Monthly Rept. for April 1951, Bureau of Mines, 1951, 10 pp.

276. _____. Corrosion Studies on Titanium and Zirconium Metals. Semi-Annual Rept. for June 1951, Bureau of Mines, 1951, 41 pp.

277. GOLDEN, L. B., SCHLAIN, D., LANE, I. R., JR., ACHERMAN, W. L., AND MACE, W. Corrosion Studies on Titanium and Zirconium Metals. Semi-Annual Rept. for December 1951, Bureau of Mines, 1951, 47 pp.

278. GOLDEN, L. B., ACHERMAN, W. L., AND MACE, W. Corrosion Studies on Titanium and Zirconium Metals. Monthly Rept. for January 1952, Bureau of Mines, 1952, 10 pp.

279. _____. Corrosion Studies on Titanium and Zirconium Metals. Monthly

Generated on 2024-09-20 18:07 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Rept. for February 1952, Bureau of Mines, 1952, 7 pp.

280. GOLDEN, L. B., ACHERMAN, W. L., AND MACE, W. Corrosion Studies on Titanium and Zirconium Metals. Monthly Rept. for March 1952, Bureau of Mines, 1952, 6 pp.

281. _____. Corrosion Studies on Titanium and Zirconium Metals. Monthly Rept. for April 1952, Bureau of Mines, 1952, 8 pp.

282. _____. Corrosion Studies on Titanium and Zirconium Metals. Monthly Rept. for May 1952, Bureau of Mines, 1952, 6 pp.

283. GOLDEN, L. B., ACHERMAN, W. L., OWINGS, A. M., AND MACE, W. Corrosion Studies on Titanium and Zirconium Metals. Monthly Rept. for July 1952, Bureau of Mines, 1952, 11 pp.

284. _____. Corrosion Studies on Titanium and Zirconium Metals. Monthly Rept. for August 1952, Bureau of Mines, 1952, 10 pp.

285. GOLDEN, L. B., ACHERMAN, W. L., AND MACE, W. Corrosion Studies on Titanium and Zirconium Metals. Monthly Rept. for September 1952, Bureau of Mines, 1952, 9 pp.

286. _____. Corrosion Studies on Titanium and Zirconium Metals. Monthly Rept. for October 1952, Bureau of Mines, 1952, 9 pp.

287. _____. Corrosion Studies on Titanium and Zirconium Metals. Monthly Rept. for November 1952, Bureau of Mines, 1952, 7 pp.

288. _____. Corrosion Studies on Titanium and Zirconium Metals. Semi-Annual Rept. for December 1952, Bureau of Mines, 1952, 33 pp.

289. _____. Corrosion Studies on Titanium and Zirconium Metals. Monthly Rept. for January 1953, Bureau of Mines, 1953, 12 pp.

290. _____. Corrosion Studies on Titanium and Zirconium Metals. Monthly Rept. for February 1953, Bureau of Mines, 1953, 11 pp.

291. _____. Corrosion Studies on Titanium and Zirconium Metals. Monthly Rept. for March 1953, Bureau of Mines, 1953, 5 pp.

292. _____. Corrosion Studies on Titanium and Zirconium Metals. Monthly Rept. for April 1953, Bureau of Mines, 1953, 8 pp.

293. _____. Corrosion Studies on Titanium and Zirconium Metals. Monthly Rept. for May 1953, Bureau of Mines, 1953, 7 pp.

294. _____. Corrosion Studies on Titanium and Zirconium Metals. Semi-Annual Rept. for June 1953, Bureau of Mines, 1953, 40 pp.

295. _____. Corrosion Studies on Titanium and Zirconium Metals. Quarterly Rept. for September 1953, Bureau of Mines, 1953, 14 pp.

GOLDMAN, J. E. See abs. 198.

296. GOLDSCHMIDT, B. L., AND PERLMAN, I. Discovery of Long-Lived Zirconium and Niobium in Uranium Fission, chap. in Radiochem. Studies: The Fission Products, Nat. Nuclear Energy Series. McGraw-Hill Book Co., Inc., book 2, vol. 9, No. 5, New York, N. Y., 1951, pp. 709-710.

An isotope of zirconium of about a 60d half-life and one of columbium (niobium) of about a 30d half-life have been found among the fission products.

GOLDSTEIN, H. See abs. 213.

GOLDWATER, D. L. See abs. 328.

297. GOLDWATER, D. L., AND HADDAD, R. E. Certain Refractory Compounds as Thermionic Emitters. Jour. Appl. Phys., vol. 22, No. 1, January 1951, pp. 70-73.

Generated on 2024-09-20 18:06 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Several refractories of the nitride, boride, and carbide families are investigated as sources of thermionic electrons. An activation pattern qualitatively common to several of the compounds is observed. Emission data for the final state of activation are presented. Data concurrently obtained for thoria are also given for comparison. True temperature used in the Richardson equation is obtained by correction from brightness temperature. Temperature correction curves have been obtained. These curves can be satisfactorily represented in the region of thermionic emission by one value of spectral emissivity, which values are listed for the materials studied.

GOOD, G. M. See abs. 740.

298. GORDON, L., VANSELOW, C. H., AND WILLARD, H. H. Precipitation of Thorium From Homogeneous Solution. Anal. Chem., vol. 21, No. 11, November 1949, pp. 1323-1325.

The reaction between thorium salts and certain dicarboxylic acids such as succinic, pthalic, and tetrachlorophthalic, proceeds extremely slowly in aqueous solution at room temperature. A visible precipitate does not form for many hours, whereas a gelatinous precipitate is obtained if the solutions are at or near boiling. When a clear solution of thorium and a dicarboxylic acid are warmed to 70° to 85° C., with continuous stirring, a thorium salt slowly precipitates in a dense, crystalline, and readily filterable form. Tetrachlorophthalic acid is the only one studied that quantitatively precipitates thorium. Upon double precipitation at pH 1.0 to 1.2, this acid effect quantitative separation of thorium from the large amounts of rare earths normally found in monazite sand. This precipitation is accomplished by a relatively simple procedure. The precipitate is ignited to the oxide. The method has been successfully employed for the determination of aluminum, gallium, thorium zirconium, and magnesium, and for separating zirconium and hafnium.

299. GORDON, R. B., AND HURFORD, W. J. Fabrication of Zirconium, chap. in Zirconium and Zirconium Alloys. Am. Soc. Metals, Cleveland, Ohio, 1953, pp. 131-145.

Reviews the development of zirconium fabrication technology from laboratory work on 2-pound ingots in 1949 to present conversion practices for 500-pound ingots. Discusses consolidation of iodide zirconium by nonfusion methods such as extrusion or hot compacting of crystal bar and pressing and sintering of zirconium hydride. Describes present practices for hot working zirconium ingots to primary shapes by forging, rolling, and extrusion. Information is given for cold rolling, drawing, swaging, forming, and machining. Discusses effects of impurities and melting practice and the effects of surface contamination during hot working and annealing on fabricability of sponge and iodide zirconium.

300. _____. How to Work Zirconium. Prod. Eng., 1954 Annual Handbook, pp. B13-B16.

This article covers characteristics of base metal, including sponge and crystal bars. Compares methods of melting. Details are given on both hot and cold working drawing and machining. A comparison is made between the Kroll and de Boer processes.

GOTTSCHALK, V. H. See abs. 154.

301. GOW, J. T., AND HARDER, O. E. Balancing the Composition of Cast 25 Percent Chromium-12 Percent Nickel Type Alloys. Trans. Am. Soc. Metals, vol. 30, December 1942, pp. 855-919.

Commercial alloys representative of 1937 production were studied to establish a base line of properties such as strength and ductility 'as cast' and 'as aged' when tested at room temperature, strength and ductility in short-time tension tests at elevated temperatures, and creep behavior at elevated

Generated on 2024-09-20 18:12 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

temperatures. Properties were correlated with microstructures. Work was then directed to studying the functional effects of the essential alloying elements and to balancing the composition with reference to austenite- and ferrite-promoting elements to produce wholly austenitic alloys. The conditions for producing wholly austenitic alloys are presented. Presents the effects of some addition agents. It is shown that austenitic alloys have better retained ductility after heating to high and intermediate temperatures and better strength at elevated temperatures and they have much better load-carrying capacity at elevated temperatures, as determined by short time tension and creep tests, than partly ferritic alloys. In alloys that are not wholly austenitic, ferrite is the stable phase at 1,800° F. (980° C.), whereas sigma is the stable phase at 1,600° F. (870° C.) and lower. Ferrite is weak but not brittle at 1,800° F. (980° C.), whereas sigma is both weak and relatively brittle at 1,600° F. and lower. Such elements as chromium, nickel, carbon, nitrogen, columbium, molybdenum, manganese, silicon, aluminum, zirconium, and titanium have been studied as to their functional effects in this type of alloys, and in some cases chromium equivalents have been estimated.

302. GRAFF, H. F. Investigations of Permanent Magnet Alloys. Arnold Eng. Co., Progress Rept. 3, 1948, 11 pp. NP-628.

This report covers progress made in experimentation being carried out on several alloys and their permanent magnet properties. Compositions of 45 alloys are given.

303. GRAHAM, J. A. Thermal Expansion Coefficients of Chromium, Titanium, and Zirconium Carbides. Royal Aircraft Est., Farnborough, Hants, August 1950, Tech. Note Met. 130, 9 pp.

The coefficients of linear thermal expansion of sintered compacts of chromium, titanium, and zirconium carbides have been determined over the temperature range of 29° - 960° C. Titanium and zirconium carbides have similar coefficients, viz., 7.9 and 7.5 x 10^{-6} respectively, over the range 20° - 960°C., whereas that of chromium carbide (Cr_3C_2) is 10.2 x 10^{-6} over the same range of temperature. The accuracy of the results is considered to be within ± 3 percent.

304. GRAHAM, R. P., VANDELEN, E., AND UPTON, A. M. Note on the Polarographic Determination of Zirconium. Canadian Jour. Chem., vol. 30, Aug. 25, 1952, pp. 1069-1072.

A useful polarographic method for the determination of zirconium can be based on the findings that m-nitrobenzoic acid is polarographically reducible and that this compound is a highly selective precipitant for zirconium. In principle, the method consists of precipitating zirconium with m-nitrobenzoic acid, dissolving the filtered and washed precipitate in hydrochloric acid, and measuring the height of the polarographic wave corresponding to the reduction of the m-nitrobenzoic acid (to the hydroxylamine stage) in a suitable supporting electrolyte. The method is accordingly an indirect one for zirconium and depends on the specificity of m-nitrobenzoic acid as a precipitant. This method has been applied successfully to the determination of zirconium in magnesium-base alloys.

305. GRAVES, A. C. Packing Fraction Differences Among Heavy Elements. Phys. Rev., vol. 55, May 1, 1939, pp. 863-867.

A group of new packing-fraction-difference measurements are reported for the following elements: Chromium, gadolinium, gold, lutecium, molybdenum, osmium, platinum, ruthenium, strontium, tantalum, tin, uranium, ytterbium, and zirconium. By combining these differences with known packing fractions, a number of new packing fractions are deduced. These are plotted on a packing-fraction

Generated on 2024-09-20 18:53 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

curve. Atomic weights of osmium and lutecium are calculated. The atomic weight of osmium is still below the chemical value, whereas that of lutecium is shown to be the same as a recent chemical determination.

GRAYSON, H. See abs. 587.

306. GREAT BRITAIN COLONIAL GEOLOGY AND MINERAL RESOURCES. Fused Stabilized Zirconia. Vol. 3, No. 4, 1953, p. 382.

A news item on importance of fused stabilized zirconia.

307. GREAVES-WALKER, A. F. Nonmetallic Mineral Resources of Florida. Ceram. Age, vol. 62, No. 5, November 1953, pp. 16-18. Presented at the Min. Eng. Conf., 61st ann. meet. Amer. Soc. for Eng. Education, University of Florida, Gainesville, Fla., Jan. 22-26, 1953.

A discussion of the development of nonmetallic mineral resources of Florida.

308. GREEN, D. E. Colorimetric Microdetermination of Zirconium. Anal. Chem., vol. 20, No. 4, 1948, pp. 370-372.

Comprises the development of an accurate colorimetric method for determining zirconium in clays or silicate rocks, using the pink lake formed by the zirconium alizarin sulfonate complex. The method applies to a range of zirconium oxide content up to 0.275 mg., with an accuracy to 0.003 mg. of zirconium oxide.

GREENBERG, S. See abs. 74.

GREENBURG, D. M. See abs. 343.

GREENEWALS, H. See abs. 77.

309. GREENSTEIN, J. L., AND ADAMS, W. S. High-Dispersion Spectra of vSagittarii. Astrophys. Jour., vol. 106, 1947, pp. 339-357.

Mount Wilson coude spectra of dispersion 2.8A/mm. cover the range λλ 3564-4861. The wave lengths and identifications of about 1,000 lines are given. The lines of H are relatively weak; those of HeI, Ni, NiI, MgII, SiII, and FeII are very strong. These lines, with other high-excitation lines, such as those of SiIII and FeIII, indicate a spectral type near B2. On the other hand, the metallic-line spectrum includes FeI, AII, and MgI, as does the spectrum of an early A star. Systemetic differences to radial velocities of the different elements are probably less than 3 km./sec. There are many apparent anomalies in the abundances of the elements. A considerable number of lines remain unidentified.

GREENWALD, H. P. See abs. 354.

GREGORY, E. D. See abs. 542, 539.

310. GRIESS, J. C., JR. Electrolytic Studies of Aqueous Solutions of Hafnium and Zirconium. Carbide and Carbon Chem. Corp., 1949, 9 pp. ORNL-204.

The behavior of aqueous solutions of zirconium and hafnium under various conditions of electrolysis has been investigated in the course of research on methods for preparing hafnium-free zirconium. It was found possible to obtain polarographic reduction waves for zirconium in perchlorate and chloride solutions, but hafnium was apparently not reducible at the dropping mercury electrode. Neither hafnium nor zirconium could be electrodeposited under the conditions studied.

311. GRIMALDI, F. S., AND MARSH, C. A. Determination of Thorium in High-Grade and Low-Grade Ores. Geol. Survey, September 1947, 17 pp. AECD-2818.

Describes a procedure for determining thorium in monazite ores, which is applicable to other ores of a wide range of composition. It is successful for both high and low (down to 0.04 percent ThO_2) grade ores. Thorium is separated from calcium, magnesium, and the bulk of the rare earths by double precipitation with ammonia, from such elements as

Generated on 2024-09-20 18:11 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

zirconium, titanium, and columbium by precipitation as fluoride, and from the remaining rare earths by peroxynitrate precipitation. Zirconium and sulfate interfere with the peroxynitrate precipitation. Conditions have been found that successfully overcome these interferences.

GROSSE, A. V. See abs. 488.

312. GROSSE, A. V., AND BOOTH, E. T. Long Life Zirconium From Uranium 235 Fission. Jour. Am. Chem. Soc., vol. 70, February 1948, pp. 465-466.

A long life zirconium of 66-day half period is described as a product of uranium 235 fission. Other zirconium isotopes from U-fission are critically reviewed.

313. _____. Radioactive Zirconium and Columbium From Uranium Fission. Phys. Rev., vol. 57, March 1940, pp. 664-665.

Discusses a method for recovering radioactive zirconium and columbium from uranium bombarded by slow neutrons from the Columbia cyclotron.

314. GROSSE, A. V., AND CONWAY, J. B. Combustion of Metals. Temple University, Oct. 15, 1951, 28 pp. NP-3549.

Discusses the suitability of burning metals as a source of high temperatures. Gives the heats of combustion of 80 elements with oxygen. The factors heat of formation, stability of products, and the use of ozone are shown to affect the maximum temperatures attainable. Describes techniques for burning solid, liquid, powdered, and gaseous metals and for pressure furnaces for solid metals. A few applications are given.

315. GRUEN, D. M. AND KATZ, J. J. Physical Properties of Some Metal Halide-Phosphorus Oxychloride Complex Compounds. Argonne Nat. Lab., June 1949, 6 pp. AECU-498.

An interesting class of compounds that has received relatively little attention are the complexes between metal halides and phosphorus oxychloride. Many of these were discovered long ago; others like the zirconium and hafnium complexes are the results of relatively recent researches. In connection with other work, some physical properties of the two latter complexes were examined.

316. _____. Separation of Hafnium and Zirconium by a Fractional Distillational Procedure. Jour. Am. Chem. Soc., vol. 71, November 1949, pp. 3843-3844.

In veiw of current interest in hafnium-zirconium separations, an investigation was undertaken of a separation method first reported by van Arkel and De Boer. This method involves fractional distillation at atmospheric pressure of the volatile complex compounds formed by reaction of zirconium and hafnium tetrachlorides with either phosphorus pentachloride or phosphorus oxychloride. Although van Arkel and De Boer showed that distillation resulted in considerable separation of hafnium and zirconium, they gave no quantitative data on the relative volatilities of the zirconium and hafnium compounds. The present work is concerned chiefly with the phosphorus oxychloride complexes.

317. GRUMMITT, W. E., AND WILKINSON, G. Fission Products of U^{233}. Nature, vol. 161, Apr. 3, 1948, p. 520.

This is a summary of the results of a survey of the longer-lived fission products of U^{233}. The data were obtained in conjunction with those previously reported, but could not be released for publication at that time.

318. GRUNEWALD, A. L. Zirconium Hydride. Fairchild Eng. and Airplane Corp., Apr. 20, 1948, 31 pp. NEPA-502; IHR-C8.

Discusses zirconium hydride in relation to shielding materials. Its properties, fabrication data, preparation, and analysis are outlined in detail.

Generated on 2024-09-20 18:04 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Equilibrium studies with other elements, structural studies, and changes in properties under exposure to radiation and nuclear data are reported.

319. GRUNEWALD, A. L. Zirconium Hydride. Fairchild Eng. and Airplane Corp., Aug. 31, 1948, 33 pp. NEPA-757; IHR-C-15.

Zirconium hydride is a black powder of the class of compounds known as metallic hydrides. Its composition is given as ZrH_x such that $0 < x < 2$. This functional composition depends on both temperature and pressure. Although it may be prepared by the direct hydrogenation of zirconium metal, it is produced commercially by the reaction of zirconium oxide (ZrO_2) and calcium hydride (CaH_2) in a hydrogen atmosphere. The crystal structure of zirconium hydride is a function of the hydrogen content. Starting initially as a hexagonal with constants a = 3.25A; c = 5.17A, it changes progressively to a face-centered cubic, close-packed hexagonal, face-centered cubic, and finally to a face-centered tetragonal of dimensions a = 4.964 Å; c = 4.440 Å, which is the hydrogen-richest phase. The density is, of course, also a function of composition and varies from 6.4, that of the metal, down to 5.57 for $ZrH_{1.75}$. The magnetic susceptibility has been determined as 1.2 x 10^{-6}/g. for ZrH and 0.9 x 10^{-6}/g. for ZrH_2. The heat of formation has been calculated to be 38.9 kcal. per mole. Molecular volumes have been stated to be 31.9 for Zr_2H and 16.4 for both ZrH and ZrH_2. The hydrogen content given as the number of hydrogen atoms per cc. has a maximum value of 7.6 x 10^{22} from room temperature to approximately 200° C. and decreases as the temperature increases beyond this point. Zirconium hydride is stable at room temperatures. It is nonhydroscopic and will not oxidize with room conditions. It can be dried in air at 100° C., but escaping hydrogen will ignite at about 350° C. in air. Although the fabrication of the hydride has not been studied, it appears that a method similar to that used for metallic zirconium powder involving the use of a binder might be feasible.

320. GUENTHER, R., AND GALE, R. H. Determination of Zirconium in the Presence of Uranium. Knolls Atomic Power Lab., KAPL-305, Mar. 10, 1950, 9 pp.

The formation of the zirconium-alizarin lake by the interaction of zirconyl and alizarin sulfonate ions and the measurement of absorbency of the lake has been investigated. A modified procedure, based on the method of Green, has been evolved for determining zirconium in uranium-zirconium alloys. The modification permits the determination of zirconium in a 2,000-fold excess of uranium. The characteristics of the zirconium alizarin lake have been reported frequently, the most recent discussion being that of Flagg, Liebhafsky, and Winslow.

GULBRANSEN, E. A. See abs. 405.

321. GULBRANSEN, E. A., AND ANDREW, K. F. Kinetics of the Reactions of Zirconium With O_2, N_2, and H_2. Metals Trans., vol. 185, August 1949, pp. 515-526.

The gas-metal reactions of zirconium are very interesting. The metal is extremely stable at room temperature to reactions with the several gases present in air and the metal will stay bright indefinitely. However, at temperatures of several hundred degrees higher, the metal reacts readily with oxygen, nitrogen, and hydrogen. This behavior, in addition to the fact that zirconium is one of the higher melting point metals, which might have high temperature applications under the proper conditions, resulted in the work reported in this communication.

322. _____. Mullite and Zircon Furnace Tubes for High Temperature and High Vacuum Systems. Ind. Eng. Chem., vol. 41, No. 12, December 1949, pp. 2762-2767.

Generated on 2024-09-20 18:24 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

One of the trends in chemical metallurgical processing of metals and other materials is the use of high vacuum at elevated temperatures. This paper describes the design, construction, and testing of refractory porcelain furnace units of double-walled construction that can be sealed directly to a Pyrex glass vacuum system. Pressures of 10^{-6} mm. of mercury or better can be obtained with these units at 1,175° C. A new method for measuring the performance of a furnace tube is suggested. This method utilizes the measurement of the rate of reaction of zirconium with gases present in the furnace tube.

323. GULDNER, W. G., AND WOOTEN, L. A. Reactions of Zirconium With Gases at Low Pressure. Jour. Electrochem. Soc., vol. 93, No. 6, June 1948, pp. 223-234.

Presents data on the reaction of zirconium with oxygen, nitrogen, carbon monoxide, carbon dioxide, hydrogen, and water vapor in the micron pressure range. The reaction products are studied by means of electron and X-ray diffraction analysis. When zirconium metal powder is exposed to carbon monoxide or carbon dioxide in the temperature range of 600° to 800° C., both zirconium dioxide and zirconium carbide are formed. In agreement with the work of de Boer and Fast, it is found that ductile zirconium strip can dissolve as much as 38 atom percent of oxygen without the formation of a new phase. Describes a new apparatus for studying gas-metal reactions at low pressure.

324. GUMP, J. R., AND SHERWOOD, G. R. Crystalline Arsenates of Zirconium and Hafnium. Anal. Chem., vol. 22, 1950, pp. 496-497.

A systematic study has been made of the factors involved in precipitating zirconium and hafnium arsenates by the formation of arsenate ions within the solution. If optimum conditions are employed, a precipitate of much better quality is obtained than the ordinary phosphate, hydroxide, or arsenate.

325. GUNNAR, K., AND HANSEN, R. S. Preparation of Hafnium-Free Zirconium. Jour. Am. Chem. Soc., vol. 71, September-December 1949, p. 4158.

A series of experiments indicate that silica gel strongly and preferentially adsorbs hafnium compounds from a zirconium-hafnium compound mixture in certain organic solvents and that this fact provides a new, simple, and effective means of preparing hafnium-free zirconium.

GUNZEL, F. H., JR. See abs. 515.

326. HACKERMAN, N., AND CECIL, O. B. Electrochemical Polarization of Zirconium in NaCl Solutions. University of Texas, Jan. 5, 1953, 25 pp.

Cathodic and anodic polarization curves of zirconium in neutral sodium chloride solutions were determined at constant current densities in the range of 3.5×10^{-6} to 3.5×10^{-3} amp./ $cm.^2$. All potentials were steady-state potentials.

327. HACKETT, P. L. Effect of Repeated Zirconium Citrate Injections on Distribution of Plutonium in the Rat. Proc. Soc. Exper. Biol. Med., vol. 83, No. 4, August-September 1953, pp. 710-712.

Serial zirconium citrate injections during the month immediately following the administration of plutonium were found to effect a 6-fold reduction in the skeletal deposition of plutonium and to increase the retention of plutonium in the soft tissues. Therapy with zirconium, commencing a month after the plutonium injection, was found to have little, if any, effect on the distribution of plutonium.

HADDAD, R. E. See abs. 297.

328. HADDAD, R. E., GOLDWATER, D. L., AND MORGAN, F. H. Zirconium Carbide as a Thermionic Emitter. Jour. Appl. Phys., vol. 20, June 6, 1949, p. 886.

Generated on 2024-09-20 18:01 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

An abstract of an article on zirconium carbide as a thermionic emitter in experimentation performed at Cathode Research group, Bartol Research Foundation of the Franklin Inst., Swarthmore, Pa.

329. HAFER, A. A. Gas-Turbine Progress Report, Materials, Cooling, and Fuels. Trans. Am. Soc. Mech. Eng., February 1953, pp. 127-136.

A discussion of high-temperature materials for gas-turbine engines.

330. HAGG, G. /X-ray Investigations of the Hydrides of Titanium, Zirconium, Vanadium and Tantalum./ Ztschr. physik. chem., sect. B, vol. 11, 1931, pp. 433-454.

Hydrides of Ti, Zr, V, and Ta have been examined by X-rays. Several hydride phases of Ti, Zr, and Ta have been found, all of which had a very simple crystal structure. Samples of hydrides of V gave no useable photographs because of the lack of homogeneity. The average value of the radius of the hydrogen atom was 0.46 Å.

331. HAHN, R. B. Determination of Small Amounts of Zirconium With Mandelic Acid. Anal. Chem., vol. 21, No. 12, December 1949, pp. 1579-1580.

Recently mandelic acid was found to be a specific reagent for the precipitation of zirconium. Kumins investigated this reagent and recommended it for determining 0.020 to 0.3 gram of zirconium oxide in the presence of titanium, iron, vanadium, aluminum, chromium, thorium, cerium, tin, barium, calcium, copper, bismuth, antimony, and cadmium. Because analyses must be made frequently of samples containing only a few milligrams of zirconium oxide, this investigation was undertaken to find if mandelic acid might be used in this range. For comparison, the same size of sample was run by the phosphate method, which is perhaps the most widely used method for determining small amounts of zirconium in ores and alloys.

332. _____. Determination of Zirconium-Hafnium Ratios With ρ-Bromomandelic Acid. Anal. Chem., vol. 23, No. 9, September 1951, pp. 1259-1261.

ρ-Bromomandelic acid can be used to determine the hafnium content in mixtures of pure zirconium and hafnium compounds. Under properly controlled conditions, a precipitate of the tetra-ρ-bromomandelates corresponding to the theoretical composition $Zr(C_8H_6O_3Br)_4$ and $Hf(C_3H_6O_3Br)_4$ can be obtained. The precipitate is dried at 120° to 130° C., weighed, ignited to the oxide, and weighed again. From these data the hafnium content of the mixture can be computed. Data are presented showing an accuracy of about ±0.5 percent (absolute) for samples containing more than 10 percent hafnia, which compared favorably with results obtained by the selenite method. In samples containing less hafnia, however, the selenite method gives more reliable results. A determination can be made in 5 to 6 hours by the ρ-bromomandelic acid method, as compared with 25 to 30 hours by the selenite method.

See also abs. 950.

HALIM, F. M. See abs. 67, 68, 69.

333. HALL, F. P. Ceramic Dense Zircon Low-Loss Material, Final Report, December 1, 1950 - June 25, 1952. Pass and Seymour, Inc., June 25, 1952, 21 pp. NP-4805.

Pilot-plant scale production of ceramic dense zircon low-loss bodies has been demonstrated. Body No. 18, as developed by the New Jersey Ceramic Research Station, has been modified for use in production in ceramic plants equipped with modern facilities. A body (1841) has been developed for cone 12 firing and a body 1861A has been developed for cone 10-11 firing. These bodies are applicable for production in the modern ceramic plants.

Generated on 2024-09-20 18:01 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

334. HALL, G. D., AND BERGER, M. J. Report on Zirconia. Fairchild Eng. and Airplane Corp., March 1948, 9 pp. NEPA-437; IHR-E12.

A discussion of zirconia from the standpoint of properties, fabrication, preparation, analysis, equilibrium, structure, and nuclear data. Effects of radiation upon the various properties are covered.

335. _____. Report on Zirconium. Fairchild Eng. and Airplane Corp., Oct. 9, 1947, 11 pp. NEPA-310; IHR-E5.

A general coverage of zirconium from the standpoint of properties, fabrication, preparation, analysis, equilibrium, structure, and nuclear data. Discusses effects of radiation upon its various properties.

336. _____. Report on Zirconium Boride. Fairchild Eng. and Airplane Corp., November 1947, 11 pp. NEPA-323; IHR-E8.

A general coverage of zirconium boride from the standpoint of properties, fabrication, preparation, analysis, equilibrium, and structure. Effects of radiation are covered.

337. _____. Report on Zirconium Nitride. Fairchild Eng. and Airplane Corp., November 1947, 11 pp. NEPA-322; AECD-2971; IHR-E7.

A general discussion of zirconium nitride from the standpoint of properties, fabrication, preparation, analysis, equilibrium, structure, and nuclear data. Covers effects of radiation upon the various properties.

338. HALL, M. B., AND NESTER, R. G. Zirconium Concentrated-Arc Infrared Source for Infrared Spectroscopy. Jour. Optical Soc. America, vol. 42, No. 4, April 1952, pp. 257-258.

Zirconium-oxide concentrated-arc lamps have been enclosed in argon-filled, water-cooled jackets provided with rock-salt or thallium bromide-iodide windows. The arcs, so altered, have operated trouble-free for thousands of hours as highly satisfactory infrared spot sources, particularly useful in infrared microspectroscopy.

339. HALL, R. Effect of Zirconium on Cast Iron. Foundry, vol. 62, No. 4, April 1934, pp. 22, 23, 54.

Zirconium was first noticed as an alloy element for steel and cast iron during the war. Some experiments on zirconium in steel were carried out at that time and subsequent work has shown its powerful deoxidizing and denitrogenizing action when added to steel. This report discusses the effects of zirconium additions to iron and steel.

340. HALLEY, J. W. Effects of Grain Growth Inhibitors in Fine Grained Steels. Steel, vol. 119, No. 10, Sept. 2, 1946, pp. 98, 99, 124.

Despite the fact that fine-grained steels have been standard products for many years, quantitative data are very meager concerning how much a certain amount of aluminum, titanium, or zirconium raised the coarsening temperature and affected the properties, all other factors being constant. An investigation was conducted to determine the effect of individual elements on grain coarsening by adding 1/4-, 1/2-, 1-, 2-, and 4-lb. grain-growth inhibitors per ton to a series of ingots of an open-hearth heat. Results of the investigation were reported in a paper presented before the Chicago meeting of the American Institute of Mining and Metallurgical Engineers.

341. _____. Grain-Growth Inhibitors in Steel. Am. Inst. Min. Met. Eng. Tech. Pub. 2030, 1946, 11 pp.

Discusses an investigation of the effects of some of the more common grain-growth inhibitors used to produce steels.

HALPERN, S. See abs. 464.

Generated on 2024-09-20 18:05 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

342. HAMILTON, J. G. Medical and Health Divisions, Quarterly Report. Radiation Lab., University of California, UCRL-480, July-September 1949, 68 pp.

Discusses the metabolic properties of plutonium and allied materials and the biological studies of radiation.

See also abs. 466, 800.

343. HAMILTON, J. G., SCOTT, K., CHAIKOFF, I. L., FISHLER, M. C., ENTENMAN, C., OVERSTREET, R., JACOBSON, L., KAPLAN, M., AND GREENBURG, D. M. Metabolism of Fission Products, Progress Report, Period Ending Feb. 15, 1943. Argonne Nat. Lab., Feb. 15, 1943, 20 pp. MDDC-1143.

A procedure has been devised for separating raw fission products without carriers from neutron-irradiated uranyl nitrate. An analysis of the final separated material which had been completely freed from uranium gave a distribution that was quite similar to the values noted by Coryell and Seaborg.

344. HAMILTON, J. G. Metabolism of Fission Products, Progress Report, Period Ending Apr. 15, 1944. Argonne Nat. Lab., Apr. 22, 1944, 26 pp. MDDC-1001.

Radiozirconium without carrier is absorbed very poorly following parenteral administration. Approximately 40 percent of the absorbed fraction is deposited in the skeleton. Excretion is slow, chiefly by way of the digestive tract and the estimated interval of time required for half of the absorbed carrier-free radiozirconium to be excreted is of the order of 80 days. Retention by the lung following intrapulmonary administration is the highest for all of the fission products, ranging from 92 percent at 4 days to 62 percent at 64 days. Absorption by way of the digestive tract is less than 0.01 percent.

HAMJIAN, H. J. See abs. 534.

345. HAMJIAN, H. J., AND DARMARA, F. N. New Process Gives Unusual Powder Parts. Iron Age, vol. 172, No. 5, July 30, 1953, pp. 98-100.

Parts with more than usually difficult contours are now being made from carbides and hard-to-melt metals such as titanium and zirconium. A new powder metallurgy method developed in Utica Drop Forge & Tool Corp. laboratory is used. Savings in materials and elimination of most machining are important contributions of the method. Only compacting and a single sintering operation are involved. The result is lower powder-part costs. Key problem solved is attainment of uniform density throughout the part. Hardness and strength values are consistent, even in undercuts and threads. Titanium parts have been pressed and sintered to tolerances of 0.008 in. and other metals have been formed to closer tolerances.

346. HAMPSON, G. C., AND PAULING, L. Structure of Ammonium Heptafluozirconate and Potassium Heptafluozirconate and the Configuration of the Heptafluozirconate Group. Jour. Am. Chem. Soc., vol. 60, November 1938, pp. 2702-2707.

X-ray photographs of ammonium heptafluozirconate indicate a Laue holohedral face-centered cubic unit of structure with a_o - 9.365 A., containing 4 $(NH_4)_3 ZrF_7$. The theory of space-groups provides no way of placing all of the atoms in definite positions in the unit. A structure involving some randomness of distribution among positions provided by the space group O_h^5 is found to account satisfactorily for the X-ray data. This structure is closely related to that of $(NH_4)_3 - AlF_6$; the $/\bar{AlF_6}/$ - complex ions are replaced by $/\bar{ZrF_7}/$ - complex ions in which zirconium has coordination number seven. Potassium heptafluozirconate is found to have a similar structure, with a_o - 8.95 A.

HANLEY, T. E. See abs. 92.

Generated on 2024-09-20 18:01 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

347. HANSEN, H. M., AND WERNER, S. Optical Spectrum of Hafnium. Nature, vol. 112, No. 2817, Oct. 27, 1923, pp. 618-619.

A discussion of a pure hafnium preparation containing, according to X-ray analysis, not more than about 1 percent zirconium, and in addition small traces of titanium, manganese, and columbium (niobium).

HANSEN, M. See abs. 167, 168, 554, 588.

HANSEN, R. S. See abs. 325.

HARDER, O. E. See abs. 301.

348. HARDING, H. E., AND DAVIES, T. A. Experimental Production of Radiographic Shadows by the Inhalation of Industrial Dusts, Part II: Zircon ($ZrSiO_4$). British Jour. Ind. Med., vol. 9, 1952, pp. 70-73.

Dense radiological shadows are produced by aggregates of phagocytes containing zircon. Apart from phagocytosis and possibly slight small cell accumulation, there is no evident reaction to the presence of zircon in the lungs of rats. Since zircon is far less toxic than silica (and possibly completely inert), and since animal experiments suggest that it is less readily inhaled into and/or retained in the lungs than the latter, it could provide a desirable substitute for silica.

HARKINS, W. D. See abs. 66.

Harman, C. G. See abs. 181.

349. HARRINGTON, R. H. Effect of Single Addition Metals on the Recrystallization, Electrical Conductivity and Rupture Strength of Pure Aluminum. Am. Soc. Metals, vol. 41, 1949, pp. 443-459.

Of 11 addition metals, the individual alloying effects of iron, magnesium, and zirconium proved most important. The electrical conductivity of 'pure' aluminum is about 64 percent of that of pure copper. In both annealed and cold-worked conditions, the addition of 0.35 percent zirconium gave outstanding rupture strength but the electrical conductivity for the cold-worked condition was lowered to 53 percent. Zirconium also raised the recrystallization temperature to about 600° C. (1,110° F.), just below the melting point. The addition of 1 percent iron, usually regarded as an undesirable impurity, yielded outstanding rupture strength for the annealed condition while maintaining a high electrical conductivity of 61 percent and raising the recrystallization temperature to about 450° C. (840° F.). Of the high conductivity materials (61.6 percent) the addition of only 0.2 percent magnesium gave the highest rupture strength for the cold-worked condition, and raising the recyrstallization temperature slightly from about 275° C. (525° F.) to about 320° C. (610° F.). This program was basic to the development of more complex compositions having high electrical conductivity and creep strengths much superior to that of commercial E. C. Grade aluminum.

350. HARRISSON, J. W., TRABIN, B., AND MARTIN, E. W. Acute, Chronic, and Topical Toxicity of Zirconium Carbonate. Jour. Pharmacol. and Exper. Therapeutics, vol. 102, May-August 1951, pp. 179-184.

Hydrated zirconium carbonate (containing 20.9 percent ZrO_2) produced no acutely toxic effects when administered to rats orally in doses ranging up to 10 gm. per kgm. of ZrO_2 or intravenously in doses ranging up to 1.5 gm. per kgm. of HZC. No symptoms of chronic toxicity were exhibited either by albino rats receiving hydrated zirconium carbonate continuously for 17 weeks in the diet in concentrations as high as 20 percent or by kittens continuously ingesting food containing as much as 5 percent of the compound. No signs of any untoward systematic effects became evident when an ointment containing 20 percent of hydrated zirconium carbonate was applied by inunction to the shaved skins of

Generated on 2024-09-20 18:01 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

guinea pigs. During this test quantities of the ointment, as high as 8 mm. per kgm. (1.68 gm. of ZrO_2 per kgm.), were massaged into the skin until absorbed. There was no evidence of sensitization when 0.5 gm. portions of the portions of the ointment were applied 12 times to the same area of the shaved skin of albino guinea pigs at weekly intervals.

HARTER, G. J. See abs. 745.

351. HARTMANN, I. Explosibility of Titanium, Zirconium, Thorium, Uranium, and Their Hydrides. Bureau of Mines, June 20, 1951, 30 pp. NYO-1562.

Discusses results of a study mode of the explosive characteristics of nine metal and metal hydride powders.

352. _____. Explosion Hazard of Metal Powders and Preventive Measures; chap. in Metals Handbook. Am. Soc. Metals, Cleveland, Ohio, 1948, pp. 52-54.

A general coverage of dust ignition hazards of metal powders including zirconium and possible preventive measures.

353. _____. Recent Research on the Explosibility of Dust Dispersions. Ind. Eng. Chem., vol. 40, No. 4, April 1948, pp. 752-758.

The Bureau of Mines began to study coal dust and gas explosions in mines over 30 years ago at its Experimental Coal Mine near Pittsburgh, Pa. This work, coupled with laboratory research on flames and combustion, has greatly advanced knowledge of the causes and characteristics of explosion phenomena and resulted in the development of effective preventive measures against mine explosions. In recent years an intensive investigation of explosions of industrial dusts and powders has been undertaken. This paper reviews briefly the nature of the dust hazard and the importance of dust explosions, discusses the various chemical and physical factors that affect dust explosibility and describes recent research by the Bureau of Mines in this field. Zirconium, titanium and other metal powders may be ignited in an atmosphere of carbon dioxide.

354. HARTMANN, I., AND GREENWALD, H. P. Explosibility of Metal-Powder Dust Clouds. Min. and Met., vol. 26, July 1945, pp. 331-335.

Discussion of the dust hazards of many metal powders and the safety measures recommended.

HARVEY, C. E. See abs. 355.

355. HASLER, M. F., AND HARVEY, C. E. Establishment of Quantitative Spectrographic Methods of Analysis of Various Raw and Finished Ceramic Materials, Second Quarterly Progress Report. Appl. Research Lab., 1947, 31 pp. NP-1937.

This report deals with the experimental investigation of the application of spectrographic methods of chemical analysis to the alkaline earth titanates and zirconates and to other materials used in the manufacture of ceramic bodies.

HAUBER, E. S. See abs. 884.

356. HAUSNER, H. H. Semiconducting Ceramic Materials. Jour. Am. Ceram. Soc., vol. 30, No. 9, 1947, pp. 290-296.

The paper presents a brief résumé on the principles of electrical conductivity. Studies were made on compositions consisting mainly of oxides such as TiO_2, Fe_2O_3, Fe_3O_4, ZrO_2, and others. The effects of composition on the electrical resistivity and its temperature coefficient of these semiconductors were investigated. Describes the reduction of the oxides and its effect on electrical properties. Test results are correlated with the theory. The effect of activation energy on electrical properties of the semiconductors also is described.

Generated on 2024-09-20 18:07 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

See also abs. 460.

357. HAUSNER, H. H., AND KALISH, H. S. Preliminary Investigation Concerning the Formation of Zirconium-Magnesium Alloys by Powder Metallurgical Methods. Sylvania Elec. Prod., Inc., SEP-38, Sept. 21, 1950, 14 pp.

Preliminary tests were made to determine the type of alloying that may occur on the zirconium-rich side of the system. The rapid volatilization of magnesium above its melting point would necessitate high-pressure melting techniques in an extremely pure inert atmosphere. Powder metallurgy techniques wherein the melting process can be avoided is a more desirable approach. Preliminary work on mixtures containing 3, 5, 10, and 15 $a/_o$ magnesium revealed that these alloys can be formed by powder metallurgy methods. The results presented in this paper are only of a preliminary nature.

358. _____. Preliminary Investigation of the Zirconium-Beryllium System. Sylvania Elec. Prod. Inc., March 1949, 29 pp. AECD-2969.

Eleven compositions of zirconium and beryllium powders were mixed, pressed at 40 t.s.i., and sintered in vacuum (1.5 x 10^{-4} mm Hg or better) at 4 different temperatures. Condition of the specimens after sintering, metallographic examination, and X-ray diffraction studies revealed enough information to enable the authors to construct a preliminary phase diagram. The system contains a relatively low melting point eutectic and several high melting point phases, including one of simple cubic structure at about 60 percent Be which melts well above 1,350° C. It appears that small amounts of zirconium in beryllium might have a marked influence upon the physical properties and also enhance a sintering of beryllium. It is shown that with powder metallurgy the study of a phase diagram can be greatly facilitated.

359. HAUSNER, H. H., KALISH, H. S., AND ANGIER, R. P. Powder Metallurgy of Zirconium. Jour. Metals, vol. 3, No. 8, August 1951, pp. 625-633.

Zirconium of high purity can be fabricated by powder metallurgy methods. The use of zirconium hydride powder for compacting and sintering leads to a more superior product than does the use of zirconium powder. The pressing and sintering conditions that permit the powder metallurgical fabrication of sintered zirconium are established. Compacting at conventional pressure of 40 - 50 t.s.i., sintering in vacuum within the temperature range 1,150° to 1,260° C., and using covered graphite boats during sintering results in sintered zirconium compacts of virtually theoretical density and appreciable ductility. The superiority of zirconium hydride powder over zirconium powder is shown clearly. It should be useful to determine how well other metal compound powders, such as hydrides, oxides, and others can be decomposed during sintering and whether this decomposition facilitates the sintering process.

360. _____. Powder Metallurgy of Zirconium. Jour. Metals, vol. 4, No. 5, May 1952, pp. 510-511.

Results of preliminary work carried out on the powder metallurgy of zirconium are summarized.

361. HAUTH, W. E., JR. Crystal Chemistry in Ceramics VII. Polymorphism. Am. Ceram. Soc. Bull., vol. 30, No. 5, May 1951, pp. 165-167.

A discussion of polymorphism and of the factors that affect the accompanying transformations as related to zirconia and titania.

362. HAVENS, W. W., WU, C. S., RAINWATER, L. J., AND MEAKER, C. L. Slow Neutron Velocity Spectrometer Studies. II. Au, In, Ta, W, Pt, Zr. Phys. Rev., vol. 71, No. 3, February 1947, pp. 165-173.

The slow neutron velocity spectrum of Au, In, Ta, W, Pt, and Zr have been

Generated on 2024-09-20 18:02 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

investigated. The results for Au and In check the values previously obtained using the 'old' system. The results for the gold level at (4.8 ± 0.1) ev with $\sigma_o\Gamma^2 = 600$, and for the main indium level at (1.44 ± 0.02) ev with $\sigma_o\Gamma^2 = 210$ agree with the earlier results. Additional indium levels were found at (3.8 ± 0.2) ev with $\sigma_o\Gamma \sim 120$ and at (8.6 ± 0.4) ev with $\sigma_o\Gamma \sim 300$. The cross-section curve for Ta below 1 ev is well matched by $\sigma = [(7.2 \pm 0.4) + (3.0 \pm 0.1)E\text{-}1/2]$. Tantalum has levels at (4.1 ± 0.1) ev with $\sigma_o\Gamma^2 \sim 44$, at (10.0 ± 0.3) ev with $\sigma_o\Gamma^2 \sim 25$, at (13 ± 0.5) ev with $\sigma_o\Gamma^2 \sim 3$, at (22 ± 2) ev with $\sigma_o\Gamma^2 \sim 18$, at (37 ± 3) ev with $\sigma_o\Gamma^2 \sim 400$, and other dips probably indicating multiple strong levels near 100 ev, 300 ev and at higher energies. The cross section curve for W below 1 ev is well matched by $\sigma = /(5.7 \pm 0.2) + (2.72 \pm 0.05)\ E\text{-}1/2/$. There are levels at (4.0 ± 0.1) ev with $\sigma_o\Gamma^2 \sim 13$, at (7.4 ± 0.2) ev with $\sigma_o\Gamma^2 \sim 5$, at (18.0 ± 0.5) ev with $\sigma_o\Gamma^2 \sim 3000$ (perhaps multiple), at (45 ± 2) ev with $\sigma_o\Gamma^2 \sim 400$ (perhaps multiple), at (180 ± 20) ev with $\sigma_o\Gamma^2 \sim 10{,}000$ if single (probably multiple), and a dip at 1100 ev which is probably multiple. The results for Pt show pronounced cyrstal interference effects in the thermal region. The $1/v$ line is probably $\sigma = /(12.0 \pm 0.3) + (1.03 \pm 0.06)\ E\text{-}1/2/$. There are levels at (11.5 ± 0.4) ev with $\sigma_o\Gamma^2 \sim 55$, at (18.2 ± 1) ev with $\sigma_o\Gamma^2 \sim 30$, and broad dips near 100 ev and near 1000 ev indicating the presence of several strong unresolved levels. The results for Zr below 0.6 ev are well matched by $\sigma = /(6.8 \pm 0.3) + (0.74 \pm 0.10)\ E\text{-}1/2/$. There are weak levels at (1.09 ± 0.03) ev with $\sigma_o\Gamma \sim 5$ and at (2.30 ± 0.07) ev with $\sigma_o\Gamma \sim 8$. A complex dip near 7 ev probably consists of two levels at $E_o = (5.7 \pm 0.5)$ ev with $\sigma_o\Gamma \sim 10$ and at (7.6 ± 0.4) ev with $\sigma_o\Gamma^2 \sim 40$.

363. HAYES, E. E. Transformation Mechanism of Zirconium. Massachusetts Inst. Technol., 1951, 65 pp. AECU-1960.

The allotropic transformation of zirconium (from a body-centered-cubic phase to a hexagonal-close-packed phase) has been investigated to obtain additional information concerning the characteristics of the mechanism. The investigation included: (1) High-speed thermal analysis, (2) attempts to retain beta zirconium at room temperature, (3) high-speed resistivity measurements, (4) attempts to determine habit relationships and (5) microstructures resulting from cooling single crystals of beta zirconium in a preferred direction. The observable characteristics of the transformation of pure zirconium have been found to differ in two respects from impure zirconium. First, the acicular character of the zirconium microstructures obtained by quenching from above the transformation temperature is absent when the zirconium is pure enough. Second, the impure zirconium exhibits sharp discontinuities in resistivity curves taken during rapid cooling through the transformation range. This indicates a 'bust' effect during the transformation that is absent in the pure zirconium. Although there is no sharp demarkation point in observing these effects as a function of impurity content, a value of about 0.1 weight-percent oxygen appears to be necessary to obtain the acicular microstructures and burst effect in the resistivity curves.

364. HAYES, E. E., AND KAUFMANN, A. R. Observations on the Alpha-Beta Transformation in Zirconium. Massachusetts Inst. Technol., MIT-1106, undated, 22 pp.

The observable characteristics of the transformation of pure zirconium have been found to differ in two respects from impure zirconium. First, the acicular character of the zirconium microstructure obtained by quenching from above the transformation temperature is absent when the zirconium is pure enough. Second, the impure zirconium exhibits sharp discontinuities in resistivity curves taken during rapid cooling through the transformation range. Although there is no sharp demarcation point in observing these effects as a function of impurity content, a value of about 0.07 to 0.1

Generated on 2024-09-20 18:13 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

weight-percent oxygen appears to be necessary to obtain the acicular microstructures and discontinuities in the resistivity curves.

HAYES, E. T. See abs. 737.

365. HAYES, E. T., DILLING, E. D., AND ROBERSON, A. H. Fabrication and Mechanical Properties of Ductile Zirconium. Trans. Am. Soc. Metals, vol. 42, 1950, pp. 619-640.

Properties of ductile zirconium produced by magnesium reduction of zirconium chloride have been determined on sheet produced by forging and rolling 10-pound ingots in air at 650° C. (1,200° F.) or sheath-protected at 850° C. (1,560° F.). Optimum annealing conditions are given for 50 percent cold-worked material. Ductile zirconium can be forged, swaged, rolled, drawn, and stamped, using conventional fabricating equipment. Other sections include the hardness of zirconium from -190 to 600° C. (-310 to 1,110° F.), impact strength in the same temperature range, ultimate strength and elongation at -190° C. (-310° F.), minimum bend radius for annealed and cold-worked sheet, and resistivity of rod and wire.

366. _____. Working Ductile Zirconium. Steel, vol. 126, 1950, pp. 82-84, 96, 99-100.

Adaptability of zirconium for stamping and drawing in producing small parts and its amenability to forging larger shapes overcome some of the restrictions imposed by lack of suitable casting methods. Satisfactory sheet and rod is forged and rolled at 1,560° F. by protecting the metal from oxidation with an iron sheath.

367. HAYES, E. T., FREDERIC, G. L., AND DILLING, E. D. Sheath Working of Zirconium Ingots. Metal Progress, vol. 61, No. 5, May 1952, pp. 82-86.

Zirconium ingots are sheathed in heavy-wall seamless mechanical tubing, welding end plugs to the sheath to form a complete seal and then working the assembly in much the same manner as a normal ingot. After forging and rolling, the iron sheath is stripped and the zirconium metal worked to finished size.

368. HAYES, E. T., AND ROBERSON, A. H. Some Effects of Heating Zirconium in Air, Oxygen, and Nitrogen. Trans. Electrochem. Soc., vol. 96, No. 9, September 1949, pp. 142-151.

Zirconium metal was heated in nitrogen, oxygen and air at from 425° to 1,300° C. Observations were made on the gain in weight, micro- and macrohardness and metallographic structures. Nitrogen diffuses into zirconium at a much slower rate than oxygen. A marked increase in penetration of both gases was found near 900° C., and this is evidently associated with the allotropic transformation from hexagonal to cubic form. Practical limits for heating zirconium in air, oxygen, and nitrogen are given and the possibilities of producing hard surface coatings are discussed.

369. HAYES, E. T., ROBERSON, A. H., AND DAVIES, M. H. Zirconium-Chromium Phase Diagram. Jour. Metals, vol. 4, No. 3, March 1952, pp. 304-306.

An investigation of the equilibrium system of binary alloys of zirconium and chromium in the composition range 0 to 50 percent Cr was undertaken, but this range was slightly extended to include the intermetallic compound $ZrCr_2$ found to exist at 53 weight-percent Cr. The main features of the diagram to be noted are: (1) Negligible solubility of chromium in α zirconium. (2) The eutectoid decomposition of β zirconium at 805° C. and 1.8 percent Cr. (3) The maximum solubility of chromium in β zirconium at the eutectic temperature of about 6.2 percent Cr. (4) The eutectic reaction occurring at 1,380° C. and 18 percent Cr. (5) The existence of an intermetallic compound $ZrCr_2$ (53 weight-percent Cr), melting at 1,525° C. The compound has a face-centered cubic Cu_2Mg type structure, a = 7.21 Å.

Generated on 2024-09-20 18:01 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

370. HAYES, E. T., ROBERSON, A. H., AND O'BRIEN, W. L. Constitution and Mechanical Properties of Zirconium-Iron Alloys. Am. Soc. Metals, vol. 43, 1951, pp. 888-904.

A diagram for the zirconium-iron system has been developed that shows a eutectoid at 2.5 percent iron and 800° C. (1,470° F.) and α eutectic at 16 percent iron and 934° C. (1,715° F.). The maximum solubility of iron in beta zirconium is 5.5 percent solubility in the alpha, or hexagonal, form is less than 0.02 percent iron. Alloys containing up to 7 percent iron can be worked at 850° C. (1,560° F.). Tensile data are given for hot-rolled, quenched, drawn, and cold-worked alloys. Heat resistance and hot strength are also included.

371. HAYES, E. T., ROBERSON, A. H., AND PAASCHE, O. G. Zirconium-Nickel Phase Diagram. Trans. Am. Soc. Metals, vol. 45, July 10, 1952, pp. 893-900; also chap. in Zirconium and Zirconium Alloys, Am. Soc. Metals, Cleveland, Ohio, 1953, pp. 275-282. Pres. at 8th Western Metal Cong. of the Am. Soc. for Metals held in Los Angeles, Mar. 23 to 27, 1953.

A diagram for the zirconium-rich portion of the zirconium-nickel system has been developed that shows a very limited solubility of nickel in alpha zirconium at room temperature. The maximum solubility of nickel in beta zirconium is 1.9 percent at 961° C. (1,762° F.). Two intermediate phases are recognized and tentatively identified as Zr_2Ni(24.4 percent Ni) and ZrNi (39.2 percent Ni). Eutectic reactions occur at 17 percent nickel and 961° C. (1,762° F.) and 27 percent nickel and 985° C. (1,805° F.).

372. HAYES, E. T., ROBERSON, A. H., AND ROBERTSON, R. H. Heat Resistance of Zirconium in Several Mediums. Jour. Electrochem. Soc., vol. 97, No. 10, October 1950, pp. 316-323.

Zirconium sheet was heated in carbon monoxide, carbon dioxide, hydrogen, sulfur dioxide, propane, and steam at atmospheric pressure. Weight changes and tensile properties were determined, metallographic structures discussed and safe heating temperatures for the metal exposed to the various gases deduced.

373. HAYES, E. T., AND STEPHENS, W. W. Metallurgy of Zirconium. Metal Progress, vol. 63, No. 5, May 1953, pp. 97-110.

A general discussion of the metallurgy of zirconium including history, production, ores, properties, impurities, fabrication, consumable-electrode melting, machining, alloys, and uses.

374. HAYES, W. G., AND JONES, E. W. Determination of Zirconium in Steel. Ind. Eng. Chem., anal. ed., vol. 13, No. 9, Sept. 15, 1941, pp. 603-604.

The authors, needing a rapid routine method for the determination of zirconium in steel and finding none that was completely satisfactory, made a search of the general literature on zirconium determinations. After investigating several methods, the precipitation of zirconium by ρ-dimethylaminoazophenylarsonic acid described by Feigl, together with the colorimetric measurement of the precipitated reagent as reported by Nazarenko, was selected as the most satisfactory approach.

375. HEALY, J. H., AND ANDREWS, A. I. Elements of the Third, Fourth and Fifth Series as Possible Adherence-Promoting Materials for Sheet-Iron Enamels. Jour. Am. Ceram. Soc., vol. 34, No. 7, July 1951, pp. 214-219.

The properties of the elements of the third, fourth and fifth series of the periodic system were analyzed from the standpoint of their adherence-promoting qualities. These elements were divided into five groups on the basis of such properties as heats of formation, melting points, vapor pressures, atomic radii, unit-cell dimensions, and hydrogen solubilities.

Generated on 2024-09-20 18:54 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

376. HEIDEL, R. H., AND FASSEL, V. A. Instrument for Internal Standard Flame Photometry and Its Application to the Determination of Calcium in the Rare Earths. Ames Lab., Iowa State College, June 28, 1950, 12 pp. AECU-875.

Gives details for simple modifications of a laboratory monochromator so that selected internal standard line pairs from flame spectra may be isolated and measured simultaneously with a multiplier phototube differential photometer. The basic design is applicable to most spectrometers or spectrographs. An atomizing system with provisions for sample recycling and recovery also is described. This equipment has been applied to the determination of calcium in the rare earths in the concentration range of 0.025 to 2.5 percent. Average deviation for a series of repeated determinations at various concentrations is about ±1.5 percent.

377. HEIN, L. B., MEGAR, G. H., AND STRIPLIN, M. M., JR. Oxidation of Phosphorus With Steam. Ind. Eng. Chem., vol. 42, No. 8, 1950, pp. 1616-1622.

Concentrated phosphoric acid and relatively pure hydrogen were produced continuously in a small pilot plant by the catalytic oxidation of phosphorus with steam at about 1,400° F. Conversion of phosphorus to phosphorus oxides was maintained essentially complete by reactivation of copper-zirconium pyrophosphate catalyst with metallic copper. The steam requirement was about 12 percent greater than the stoichiometric requirement for producing 100 percent orthorphosphoric acid. Graphite blocks joined with a sodium silicate-coke breeze cement as a material of construction satisfactorily resisted attack of condensing phosphorus acids. The process was shown to be technically feasible and offers promise of an inexpensive source of hydrogen to producers of phosphoric acid from elemental phosphorus.

378. HEINE, H. W., COTTLE, D. L., AND VAN MATER, H. L. Comparison of Zirconium Tetrachloride With Aluminum Chloride as a Friedel-Crafts Catalyst. Jour. Am. Chem. Soc., vol. 68, 1946, p. 524.

The recent availability of zirconium tetrachloride in commercial quantities has prompted the investigation of this material as a catalyst for the synthesis of ketones according to Friedel and Crafts. Krishnaumurti previously has reported the preparation of the ketones, acetophenone, and benzophenone. A preliminary comparison of zirconium tetrachloride with aluminum chloride has been conducted by measuring the yields of p-methyl-acetophenone from acetyl chloride and toluene. The procedure and analytical method used in this investigation were essentially those developed by Dermer and co-workers.

379. HEINE, R. W. Deoxidation of White Cast Iron, Part I. Foundry, vol. 77, No. 8, August 1949, pp. 74-78, 229-230.

Deoxidation treatments applied to white cast irons have been shown to affect some fundamental phenomena of the malleabilizing process. The number of graphite nuclei developed during first stage graphization are markedly affected by the amount and kind of deoxidizing addition. The time required for the first stage graphization is decreased by deoxidizing treatments when the element added functions primarily as a deoxidizer. Residual percentage of carbide stabilizing elements promote resistance to graphization. As a result of the effects produced when white cast irons are treated with deoxidizers, it is concluded that oxygen in the forms in which it exists in white iron promotes resistance to graphitization.

380. _____. Deoxidation of White Cast Iron, Part II. Foundry, vol. 77, No. 9, September 1949, pp. 84-85, 239-243.

In this second and concluding article on the role of oxygen in malleable iron metallurgy, the author discusses the practical application and interpretation

Generated on 2024-09-20 18:07 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

of the principles discussed in Part I. Use of deoxidizers and relative deoxidizing properties of various elements are described.

381. HENNIG, R. W., AND NISBET, J. D. Development of Zirconium Base Alloys. G. E. Co., Research Lab., Jan. 3, 1949, 4 pp.

A program has been undertaken to develop zirconium base alloys for possible application in the field of atomic energy. This shall consist of the melting and casting of specific alloys, the physical testing of these metals, and the evaluation of test results. This report covers the first phase of the program, the development of equipment necessary for melting zirconium and zirconium base alloys. The detailed alloy plans are nearly complete but will be discussed in a later report.

382. _____. Development of Zirconium Base Alloys (Second Quarterly Report). G. E. Co., Research Lab., July 1, 1949, 11 pp.

A small arc furnace for producing zirconium alloys has been constructed. Titanium ingots weighing up to 340 grams have been produced and considerable knowledge concerning the operation of the furnace and of the melting technique to be employed has been gained. Vacuum equipment for use with a larger furnace has been installed and tested.

383. HENNIG, R. W., MOORE, W. F., AND NISBET, J. D. Development of Zirconium Base Alloys (Third Quarterly Report). G. E. Co., Research Lab., Oct. 1, 1949, 11 pp.

Discusses construction and operation of a large arc melting furnace. Melting techniques have been established using the small furnace and a deoxidation experiment performed in the interest of obtaining purer zirconium. The vacuum system of the large arc melting furnace must be improved and an investigation of zirconium-magnesium alloys is planned for the immediate future.

384. HENNIG, R. W., AND NISBET, J. D. Development of Zirconium Base Alloys (Fourth Quarterly Report). G. E. Co., Research Lab., Jan. 1, 1950, 6 pp.

A report on zirconium arc melting during the last quarter of 1949. Describes newly designed equipment for preparing refractory alloys and outlines plans for future work.

385. PUGH, J. W. Development of Zirconium Base Alloys (Fifth Quarterly Report). G. E. Co., Research Lab., Apr. 5, 1950, 11 pp.

Casting apparatus that will make refractory alloys as large ingots either of constant or gradient composition has been constructed and preliminary tests made on it. Some mechanical tests were made on arc-cast zirconium, and six zirconium-chromium alloys were made, machined to tensile test bars, and heat treated.

386. _____. Development of Zirconium Base Alloys (Sixth Quarterly Report). G. E. Co., Research Lab., July 5, 1950.

An illustrated description of a new automatic loading arc casting furnace. This furnace is expected to satisfy a desire for larger ingots and make possible the manufacture of individual ingots of variant composition. In addition, construction of a zirconium sponge degassing furnace and high-temperature creep-rupture testing furnaces are described. Notes physical properties and response to heat treatment of zirconium-chromium alloys observed thus far.

387. NISBET, J. D. Development of Zirconium Base Alloys (Seventh Quarterly Report). G. E. Co., Research Lab., Apr. 5, 1951, 7 pp.

During this quarter a vacuum furnace for degassing raw materials was completed and is now being tested. The capabilities of the arc-melting equipment were

Generated on 2024-09-20 18:04 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

critically reviewed, and a program to improve the deficiencies was planned. A new type of creep-rupture testing machine was developed, and the first model has been completed. Arc melting of zirconium alloys was restricted because a supply of iodide zirconium was not available until very recently.

388. KEELER, J. H. Development of Zirconium Base Alloys (Eighth Quarterly Report). G. E. Co., Research Lab., Oct. 5, 1951, 5 pp.

During the tenth quarter, a quick survey of prospective alloy systems was planned, 28 zirconium binary ingots were made, and fabrication was begun. Adaptation and testing of the Instron Tensile Tester, the creep capsule and the large arc-melting furnace were carried out.

389. _____. Development of Zirconium Base Alloys (Ninth Quarterly Report). G. E. Co., Research Lab., Jan. 5, 1952, 23 pp.

Spectrographic analyses of crystal-bar zirconium and chemical analyses of zirconium-rich binary alloys were obtained. The preferred orientation of severely cold rolled crystal bar was determined. The allotropic transformation temperature was measured for Grade 2 cyrstal bar and for the first binary alloy containing tantalum. The mechanical properties of (1) cold-rolled, (2) recrystallized, and (3) arc-melted, cold-rolled and recrystallized crystal-bar material were studied by obtaining true stress-true strain data at room temperature. Similar studies were made for recrystallized binary alloys of zirconium containing tantalum and alloys containing columbium (niobium).

390. _____. Development of Zirconium Base Alloys (Tenth Quarterly Report). G. E. Co., Research Lab., Apr. 5, 1952, 38 pp.

The recrystallization and transformation textures of rolled crystal-bar zirconium were determined. The influence of grade, grain-size, strain rate, and specimen orientation of tensile properties were studied. Relations between texture and strain hardening and between texture and deformation during necking were observed. True stress-true strain data at room temperature were obtained for recrystallized binary alloys of zirconium containing columbium (niobium), chromium or aluminum.

391. _____. Development of Zirconium Base Alloys (Eleventh Quarterly Report). G. E. Co., Research Lab., July 5, 1952, 32 pp.

Transformation, deformation and recrystallization textures for rolled crystal-bar zirconium were determined. The improved arc-melting process was evaluated. Tensile properties of crystal-bar zirconium and of binary alloys of zirconium containing chromium, aluminum, or tantalum were determined in the temperature range from 200° to 370° C. The temperature dependence of the rate sensitivity of severely cold-reduced and of annealed crystal bar was also studied.

392. KEELER, J. H., HIBBARD, W. R., JR., AND DECKER, B. F. Development of Zirconium Base Alloys (Twelfth Quarterly Report). G. E. Co., Research Lab., Oct. 5, 1952, 13 pp.

Textures of cold-rolled and annealed crystal-bar zirconium and of hot-rolled zirconium were determined and are summarized with the deformation and annealing textures previously discussed in project reports.

393. KEELER, J. H. Development of Zirconium Base Alloys (Thirteenth Quarterly Progress Report). G. E. Co., Research Lab., Jan. 5, 1953, 4 pp.

The tensile behavior of unalloyed zirconium has been studied and an occasional report is being prepared. The tensile properties of Zr-Al, Zr-Cr, Zr-Mo and Zr-Fe binary alloys are being determined at temperatures as high as 300° C., and specimens for constitution studies of the Zr-Cb, Zr-Ta and Zr-V systems have been made. Equipment for

Generated on 2024-09-20 18:10 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

elevated temperature tests in an inert atmosphere is being tested and additional preferred orientation studies are being carried out.

394. KEELER, J. H. Development of Zirconium Base Alloys (Fourteenth Quarterly Report). G. E. Co., Research Lab., Apr. 5, 1953, 5 pp.

Additional tensile tests of zirconium-aluminum, zirconium-molybdenum, zirconium-tantalum, and zirconium-columbium (niobium) binary alloys were carried out at temperatures up to 200° C. A modified end-quench apparatus has been constructed to further investigate the influences of thermal treatments on the properties of zirconium alloys. The tensile properties of unalloyed zirconium were determined at -195° C., and the melting temperature of crystal-bar zirconium was determined at 1,868° ± 10° C.

395. _____. Development of Zirconium Base Alloys (Fifteenth Quarterly Report). G. E. Co., Research Lab., July 5, 1953, 9 pp.

Zirconium-aluminum binary alloys were further studied by tensile tests at 500° C. in argon and at -195° C. in liquid nitrogen, by the preparation of several Zr-Al intermetallic compounds and by the cold-rolling at room temperature of alloys containing up to 10 atomic percent aluminum. An aging study of the Zr-Al system was also begun. Preliminary data concerning other zirconium binary alloys are included and additional data concerning the grain-size effect in rolled and annealed crystal-bar zirconium are reported.

396. _____. Development of Zirconium Base Alloys (Sixteenth Quarterly Report). G. E. Co., Research Lab., Oct. 5, 1953, 6 pp.

Additional tensile tests were conducted on zirconium binary alloys in the temperature range - 195° to 500° C. Yield-strength data are presented. Deformation textures melting temperature of crystal-bar zirconium has been redetermined as 1,852° ± 2° C.

HENRY, D. E. See abs. 729, 730.

397. HENSEL, F. R., LARSEN, E. I., AND DOTY, A. S. Beneficial Effects of Zirconium in Cast Nickel-Silicon Bronzes. Trans. Am. Inst. Min. Met. Eng. Tech. Pub. 1237, 1940, 4 pp.

The alloy under discussion is a nickel-silicon bronze and is one of many age-hardening or precipitation-hardening copper-base alloys. The hardening constituent is a nickel-silicon compound. The quenching temperature necessary to produce hardening by a subsequent aging treatment is a function of the composition and extends from about 700° to 950° C.; the aging-temperature range extends from 400° to 600° C.

398. HEPPLEWHITE, J. W. Effect of ZrO_2 and TiO_2 Upon the Resistance to Crazing of a Typical Glaze for Semivitreous Dinnerware. Jour. Am. Ceram. Soc., vol. 20, 1937, pp. 60-61.

This report is directed toward a study of the effect of some zirconium compounds as well as titanium dioxide upon a typical semivitreous dinnerware glaze. Studies were made an 'Opax,' a processed zirconium oxide and on 'milled zircon,' a finely milled refined zirconium silicate.

HERGERT, W. F. See abs. 506.

399. HERRES, O. Newer Metals. Mines Mag., January 1953, pp. 33-36.

A discussion of the newer metals including zirconium from the standpoint of resources, industrial future, producers, metallurgical problems, and the ability of American enterprise to maintain a steady flow of raw materials.

400. HERRES, S. A., AND DAVIS, J. A. Arc Melting Refractory Metals. Steel, vol. 124, No. 18, May 2, 1949, pp. 82-86.

Generated on 2024-09-20 18:10 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Describes a simple laboratory arc melting furnace, which is being used for experimental investigation of alloys of titanium, zirconium, chromium, molybdenum, or tungsten. Furnace consists of an enclosed water-jacketed copper crucible and a vertically movable, water-cooled, tungsten-tipped electrode. Arc current is supplied by one or more welding generators.

HESSING, H. See abs. 550.

401. HEVESY, G. Atomic Weights of Zirconium and Hafnium. Nature, vol. 115, No. 2888, Mar. 7, 1925, pp. 335-336.

By taking into account the presence of hafnium, Venable and Bell corrected their measured atomic weight of zirconium to 91.3, which is in close agreement with Astons estimate of 91.2 to 91.4 derived from positive ray data. Honigschmid and Zintl report 178.32 to 177.78 for zirconium-contaminated hafnium. Jantzen by X-ray analysis for zirconium was able to correct their values to a range of 178.57 to 178.64.

402. _____. Hafnium Content of Some Historical Zirconium Preparations. Nature, vol. 113, No. 2837, Mar. 15, 1924, pp. 384-385.

An investigation and discussion of a number of ores containing zirconium. All such ores revealed the presence of hafnium.

See also abs. 134, 135, 136.

403. HEVESY, G., AND BERGLUND, F. Density of the Oxides of Zirconium and Hafnium. Jour. Chem. Soc. (London), vol. 125, No. 2, 1924, pp. 2372-2375.

A method to prepare pure oxides of zirconium and hafnium is given. The densities are determined by a picnometer using water to fill the voids. There is enough difference in the density of these oxides to permit the calculation of the percent composition of their mixtures with a fair degree of accuracy. Columbium and tantalum oxides are amenable to the same methods.

404. HEVESY, G. AND LEVI, H. Radiopotassium and Other Artificial Radio-Elements. Nature, vol. 135, Apr. 13, 1935, p. 580.

A discussion of formation of radioactive zirconium by bombardment with moderated neutrons - also includes hafnium.

HIBBARD, W. R., JR. See abs. 392.

405. HICKMAN, J. W., AND GULBRANSEN, E. A. Oxide Films Formed on Titanium, Zirconium, and Their Alloys with Nickel, Copper, and Cobalt. Anal. Chem., vol. 20, No. 2, February 1948, pp. 158-165.

The electron diffraction technique is used to study the structures of the oxides that form on the metals titanium and zirconium and on the alloys, 50 Ti-Ni, 70 Ti-Ni, 28 Ti-Cu, 20 Zr-Cu, 60 Zt-Co, and 70 Zr-Ni in the temperature range 300° to 700° C. The structures found are plotted on existence diagrams as functions of time and temperature. Attempts are made to correlate the structures obtained with thermodynamic data reported by other workers. The oxides occurring on titanium and zirconium are titanium dioxide (rutile) and the monoclinic modification of zirconium oxide, respectively. Titanium displays greater oxidation resistance than zirconium, which shows evidence of solid solubility of the oxide in the metal. Titanium-nickel alloys show only the presence of rutile, whereas the titanium-copper alloy yields cuprous oxide below 500° C. and rutile above 500° C. Zirconium alloys do not show the presence of zirconium dioxide even though thermodynamic data indicate that it should be observed. Zirconium ion appears to have lower rates of formation and diffusion than cobalt, copper, and nickel ion.

HIGGINS, W. F. See abs. 195.

HILLIARD, A. See abs. 868.

Generated on 2024-09-20 18:07 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

HINCKLEY, J. A. See abs. 131.

HOAGLAND, E. J. See abs. 463.

HOBDAY, R. W. See abs. 436.

406. HODGE, J. M. Effects of Alloying Elements on the Microstructure and Properties of Steel. Steel Process., vol. 33, December 1947, pp. 746-750.

Alloying elements in solution in ferrite will strengthen the ferrite and therefore alloy steels containing elements that dissolve in the ferrite phase, such as silicon, nickel, or copper, will be stronger for a given carbon content and microstructure than the corresponding plain carbon steel. Advantage is taken of this fact in many of the common low alloy high strength steels that are used in the 'as rolled' condition.

407. HOEKSTRA, H. R., AND KATZ, J. J. Preparation and Properties of the Group IV-B Metal Borohydrides. Jour. Am. Chem. Soc., vol. 71, No. 7, May-August 1949, pp. 2488-2492.

Borohydrides of all the members of Group IV-B of the Periodic Table have have been prepared. Tetravalent borohydrides of thorium, hafnium, and zirconium and the trivalent compound of titanium were obtained. The borohydrides of thorium, zirconium, and hafnium were found to be the most volatile known compounds of these elements. Titanium borohydride is the most volatile known compound of trivalent titanium. Thorium borohydride is the most salt-like compound in this group, resembling the lithium and sodium compounds in its properties. Hafnium and zirconium borohydrides are low melting, volatile solids more nearly resembling aluminum borohydride. Titanium borohydride is the least stable compound of this type prepared to date. As yet, no general method for the preparation of Group IV-B metal borohydrides has been discovered. The reaction of aluminum borohydride with the anhydrous metal tetrafluoride can be used for thorium. Fusion of the tetrafluoride with sodium fluoride to form the corresponding double salt is necessary in the case of hafnium and zirconium, whereas the titanium salt has been prepared by the action of lithium borohydride on titanium tetrachloride.

408. HOFFMAN, C. A., AULT, G. M., AND GANGLER, J. J. Initial Investigation of Carbide-Type Ceramal of 80-Percent Cobalt for Use as Gas-Turbine-Blade Material. Nat. Advisory Comm. Aeronautics, March 1949, 49 pp. NACA-TN-1836.

An investigation was conducted to determine the material problems arising in the use of a carbide-type ceramal for gas-turbine blades. Specimens of an 80 percent titanium carbide plus 20 percent cobalt (by weight) ceramal were investigated for short-time tensile-strength characteristics at 1,800° and 2,200° F. and for thermal-shock characteristics at 1,800°, 2,000°, 2,200° and 2,400° F. Gas-turbine blades of this material were operated in a quasi-service-evaluation unit. The 1,700° and 2,200° F. and turbine tip speeds between 478 and 835 feet per second. A commercial tensile machine, a specially designed furnace and air-quench-chamber apparatus and a small gas turbine were used for these investigations. X-ray-diffraction studies were made of the material before and after operation in the form of turbine blades. For comparison purposes, zircon and titanium carbide ceramics and an alloy were investigated for thermal-shock characteristics and turbine-blade performance, respectively.

409. HOLDEN, R. B., AND KOPELMAN, B. Hot-Wire Process for Zirconium. Sylvania Elec. Prod., Inc., SEP-58 (X) (rev.), June 28, 1951, 28 pp.

In order to better understand the hot-wire process for zirconium, a study has been made of the thermal decomposition of zirconium tetraiodide molecules that are isolated from the effects of interaction with other tetraiodide molecules and with the reaction products. It was found that the probability that a given zirconium tetraiodide molecule will decompose upon

Generated on 2024-09-20 18:11 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

striking once upon a hot surface in vacuo is very high approaching unity at 1,400° C. This work was supplemented and extended by a second series of investigations, which were based upon pressure measurements made inside of an operating cracking bottle. From these two experimental approaches considerable information was gained about the hot-wire process, including a knowledge that the rate-determining step is that of gaseous transport and that the initial synthesis of zirconium tetraiodide in the cracking bottle is catalyzed, apparently photochemically, by the lighting from the filament.

HOLMES, H. P. See abs. 503.

410 HOLNESS, H., AND KEAR, R. W. Determination of Zirconium in Minerals and Refractories by the Tannin Method. Analyst, vol. 74, September 1949, pp. 505-507.

The standard methods for the analysis of zirconium minerals and refractories are all subject to a number of difficulties. This work has been undertaken in an attempt to devise a method in which some of these difficulties are overcome. Describes a modification of the standard method for determining silica in zirconium materials, together with a procedure for the use of tannin in the analysis of zirconium minerals and refractories. The use of the reagent offers a comparatively rapid method for determining $ZrO_2 + TiO_2$ and $Fe_2O_3 + Al_2O_3$ in these materials. Attention is drawn to the introduction of silica into the analysis by attack on the glassware by dilute solutions of ammonia.

411. HOLT, M. L. Attempts to Electrodeposit Zirconium. Jour. Electrochem. Soc., vol. 98, No. 3, March 1951, pp. 33C-35C.

The work described was carried out with the hope of finding a definite answer, either positive or negative, to the question, 'Can zirconium be electrodeposited from solution?' Attempts were made to electrodeposit zirconium and, in some cases, zirconium alloys from numerous aqueous and nonaqueous solutions. None of the solutions used gave a weighable electrodeposit of pure zirconium, but some solutions gave thin cathode deposits that contained zirconium and iron. No work with fused salt baths for zirconium is included.

HOOGTEIJLING, P. J. See abs. 826.

HOOPER, B. See abs. 650.

412. HORAK, W., AND SHARP, D. E. Note on the Effect of Zirconia on the Chemical Durability of Some Borosilicate Glasses. Jour. Am. Ceram. Soc., vol. 18, 1935, pp. 281-282.

Four meltings were made on a small scale of a borosilicate glass in which ZrO_2 was progressively substituted for Al_2O_3. Determinations of chemical durability showed that the substitution increased the resistance of the glasses to weathering.

413. _____. Note on the Influence of Zirconia on the Elasticity of Some Soda-Lime Glasses. Jour. Am. Ceram. Soc., vol. 18, 1935, pp. 283-284.

Measurements of the moduli of elasticity and of rigidity were made on four soda-lime glasses containing ZrO_2. Both moduli are lowered by the substitution of ZrO_2 for CaO.

414. HORTON, A. D. Spectrophotometric Determination of Zirconium. Oak Ridge Nat. Lab., 1952, 15 pp. AECD-3482.

Development work is being continued on the use of Thoron /1-(o-arsonophenylazo)-2-naphthol-3,6-disulfonic acid/ as a spectrophotometric reagent. Its previous use for the determination of thorium (IV), titanium (IV), hafnium (IV) and zirconium (IV) indicates that thoron may be specific for metals that have a valence of plus four in the formation of their salts. Thoron has been used successfully for determining zirconium. The method covers a range of 10 to 100 μg of zirconium with a precision of 5.7 percent

Generated on 2024-09-20 18:08 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

in the 10 μg range and 2.9 percent in the 100 μg range. The method is simple, rapid, and does not require a skilled analyst. The reagent, although complex, is now available commercially and requires little preparation. There are very few interferences that cannot be reduced to noninterfering states or removed from the sample without loss of zirconium.

HOSHINO, S. See abs. 771.

415. HOSKING, K. F. Flash Fusion Tests for Economic Minerals. Min. Mag., vol. 89, September 1953, pp. 137-142.

Methods are described for the rapid fusion of minerals with fluxes and for the rapid reduction of sulphates and phosphates. A 'flash fusion' takes less than a minute. The fusions are usually carried out on an inverted Pyrex dish or an asbestos paper. A mixture of the powdered mineral and flux, or sometimes the mineral powder alone, is covered with sodium peroxide and a burning splint applied to the latter. An alternative procedure involves covering the mineral, with or without admixed flux, with sodium peroxide, which in turn is covered with photographer's flash powder. This charge is ignited by touch paper. Reductions are obtained by covering the powdered mineral with flash powder upon which has been placed a little oxidizing agent to permit of easy ignition. The charge is ignited by one of the methods noted above. Subsequent examination of the products by spot or other tests is fully described. The advantages of flash fusion and reductions as compared with the usual methods are noted.

416. HOWARD, J. W. Zircon. Jour. Chem. Ed., vol. 17, 1940, pp. 265-267.

Zircon is chiefly zirconium silicate ($ZrSiO_4$), although most specimens contain traces of many other elements. It has a wide geographical distribution. Its chief use is as a gem stone, its clearness, fire, and adomantine luster making it a close rival to the diamond.

HOWATSON, J. See abs. 523.

HOWELL, L. J. See abs. 475, 476.

417. HUBBARD, J. S., HUMPHREYS, I. B., AND BROWN, W. E. How Humphreys Spiral Concentrator is Used in Modern Ore Dressing Practice. Min. World, vol. 15, No. 6, May 1953, pp. 40-45.

Discusses application of the Humphreys' spiral concentrator to ore dressing. Ores in various parts of the country are covered, including zircon.

418. HUDGENS, J. E., JR. AND DABAGIAN, H. J. Radioactivation Determination of Zirconium in Zirconium-Hafnium Mixtures. Nucleonics, vol. 10, No. 5, May 1952, pp. 25-27.

Zr concentration, in mixtures ranging from nearly pure Zr to as little as a few tenths p.p.m., can be determined within about 1 percent by combining slow-neutron activation and radio-chemical separation, as described.

419. HUFFMAN, E. H., AND BEAUFAIT, L. J. Fractional Separation of Zirconium and Hafnium by Extraction With Thenoyltrifluoracetone. Jour. Am. Chem. Soc., vol. 71, September 1949, pp. 3179-3182; Radiation Lab., University of California, November 1948, 5 pp. AECD-2387.

The work reported in this paper on the separation of zirconium and hafnium using this β-diketone was undertaken at the suggestion of M. Calvin and G. T. Seaborg. A study has been made of some differences in the extractions of zirconium and hafnium by benzene solutions of thenoyltrifluoroacetone (referred to as HT in equations and tables) from aqueous 2 M perchloric acid and the results applied to separations of these elements.

420. HUFFMAN, E. H., IDDINGS, G. M., AND LILLY, R. C. Anion Exchange of Complex Chloro-Ions of Zirconium, Hafnium, Niobium, and Tantalum. Radiation Lab., University of

Generated on 2024-09-20 18:06 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

California, UCRL-1165, Mar. 2, 1951, 8 pp.

It has been found that zirconium, hafnium, columbium (niobium), and tantalum form complex chloro-ions in strong hydrochloric acid that can be exchanged on anion exchange resins. Some of the characteristics of these exchanges have been studied and are given in this report.

421. HUFFMAN, E. H., AND LILLY, R. C. Anion Exchange of Complex Fluo-Ions of Zirconium and Hafnium. Radiation Lab., University of California, UCRL-878, Aug. 23, 1950, 21 pp.

The elution of complex fluo-ions of zirconium and hafnium from an anion exchange resin with mixtures of hydrochloric and hydrofluoric acids has been studied in two different concentration ranges. Differences in the dependence of the distribution coefficient upon both the chloride ion concentration and upon the hydrofluoric acid concentration have been noted for the two ranges, and some possible ionic equilibria are discussed in connection with the data.

422. _____. Anion Exchange Separation of Zirconium and Hafnium. Radiation Lab., University of California, UCRL-2714, Aug. 3, 1949, 3 pp.; Am. Chem. Soc., vol. 71, No. 12, December 1949, p. 4147.

A successful anion-exchange separation of zirconium and hafnium has been attained by elution of their fluo-salts from Amberlite IRA-400 with hydrochloric acid containing a small amount of hydrofluoric acid.

423. HUGHES, D. J., KATO, W. Y., AND LEVIN, J. S. Energy Levels in Hafnium Isotopes. Bull. Am. Phys. Soc., vol. 28, No. 5, Sept. 2, 1953, p. 22.

An abstract of an article on work carried out with the Atomic Energy Commission on nuclear energy levels in hafnium isotopes at the Brookhaven National Laboratory.

424. HUKAGAWA, S., AND NAMBO, J. Adsorption Properties of Metallic Zirconium for Gases and Its Applications to Electron Tubes. Electrochem. Jour. (Japan), vol. 5, 1941, pp. 27-30.

Many factors influence the life of a vacuum tube but the most common is deterioration, directly or indirectly, of its degree of vacuum. For the purpose of maintaining a high degree of vacuum the clean-up action of various metals was experimented upon. Hitherto, barium, magnesium, etc. have been used for this purpose, but if a great quantity of the metal is used to increase this action, electrical leakages, electron emission, and various other undesirable results occur. Therefore, an endeavor was made to find a substance that has high gas absorption or adsorption power and low vapour pressure and, from the point of manufacturing vacuum tubes, is easy to handle. Zirconium especially meets these requirements.

425. HULL, A. W. Crystal Structure of Titanium, Zirconium, Cerium, Thorium, and Osmium. Phys. Rev., vol. 18, No. 2, 1921, pp. 88-89.

X-ray powder diffraction patterns of these metals were taken in a manner, previously described in Physical Review, vol. 10, p. 661, 1917, using a molybdenum water-cooled X-ray tube, with Zr filter. The positions of the lines on the patterns were measured on a slide rule and the corresponding planar spacings calculated by the Bragg formula.

426. HUME, D. N. Determination of Zirconium Activity in Fission by the Barium Fluozirconate Method; chap. in Radiochem. Studies: The Fission Products, Nat. Nuclear Energy Series. McGraw-Hill Book Co., Inc., book 3, vol. 9, No. 6, New York, N. Y., 1951, pp. 1499-1503.

A rapid and direct method has been developed for determining zirconium activity in fission mixtures. Radioactive interchange has been shown to be complete.

Generated on 2024-09-20 18:04 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Decontamination from other activities is satisfactory.

427. HUME, D. N. Note on Removal of Zirconium and Niobium From Amberlite Resin Adsorbent; chap. in Radiochem. Studies: The Fission Products, Nat. Nuclear Energy Series. McGraw-Hill Book Co., Inc., book 3, vol. 9, No. 6, New York, N. Y., 1951, pp. 1521-1522.

The HF eluate of Amberlite IR-1 resin columns holding adsorbed fission products contains the zirconium and columbium (niobium) activities. Tracer zirconium was prepared in low yield from this solution. The columbium activity could not be separated from a white solid that carried the activity.

428. _____. Radiochemical Activity Analysis. Anal. Chem., vol. 21, No. 3, March 1949, pp. 322-326.

Radiochemical activity analysis is defined as the identification and determination of the radioactivity owing to individual constituents in mixtures of radioactive materials. Describes physical methods of identification of individual radioactivities and chemical methods for the resolution of mixtures. Addition of a known amount of inactive carrier and determination of the efficiency of recovery of the isolation process permit short-cut methods to be used in quantitative determinations and greatly cut the time necessary for an analysis. Methods for the rapid determinations of radioactivity owing to each of the fission elements have been developed and the procedure for zirconium activity is discussed in detail. Applications in radioactive tracer production and utilization are suggested.

See also abs. 934.

429. HUME, D. N., HUMPHREY, M., AND McCABE, C. I. Determination of Zirconium Activity in Solutions Containing Lanthanum; chap. in Radiochem. Studies: The Fission Products, Nat. Nuclear Energy Series. McGraw-Hill Book Co., Inc., book 3, vol. 9, No. 6, New York, N. Y., 1951, pp. 1504-1506.

Presents a procedure for the determination of zirconium activity in concentrated lanthanum solutions. The method is a modification of the fluozirconate procedure; it makes use of a preliminary $Zr_3(PO_4)_4$ precipitation to prevent the loss of zirconium carrier by coprecipitation on LaF_3.

HUMENIK, M., JR. See abs. 484, 485.

430. HUMENIK, M., JR., AND KINGERY, W. D. Metal-Ceramic Interactions: III, Surface Tension and Wettability of Metal-Ceramic Systems. Jour. Am. Ceram. Soc., vol. 37, No. 1, January 1954, pp. 18-23.

The wettability and adherence of metal-ceramic systems were investigated, using a precise sessile-drop method. The surface tension and wettability of silicon, iron, and nickel in contact with various refractory materials were evaluated at elevated temperatures. Measurements were carried out in vacuo, in hydrogen, and in helium. Nonwetting contact angles were observed for iron and nickel with oxides, whereas silicon was found to wet the oxides partly. The wettability was greater for the metal-graphite and beryllium carbide systems than for the metal-oxide systems. The nature of the atmosphere was found to have a significant effect on the wettability and surface tension of the metal.

431. HUME-ROTHERY, W. Metallic Carbides and Nitrides of the Type MX. Phil. Mag., vol. 44, No. 357, October 1953, pp. 1154-1160.

Discusses the structures of the metallic carbides and nitrides of the type MX with the sodium chloride structure. The view that this structure is formed in order to provide the nonmetallic atom with an octahedral interstice is shown to be improbable or only part of the truth, and it is considered that the face-centered cubic arrangement with the metal atoms is favored mainly because it

Generated on 2024-09-20 18:55 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

provides the metallic atoms with mutually perpendicular bonds to six neighbors. The melting points are discussed, and the need for further work on the electrical properties of these compounds is emphasized.

HUMMERS, W. S. See abs. 105.

432. HUMMERS, W. S., TYREE, S. Y., JR., AND YOLLES, S. Compounds of Zirconium and Hafnium Tetrachlorides With Esters. Jour. Am. Chem. Soc., vol. 74, No. 1, Jan. 5, 1952, pp. 139-141.

Zirconium tetrachloride . 2-ethyl benzoate, zirconium tetrachloride . 2-methyl benzoate, zirconium tetrachloride . 2-phenyl benzoate, hafnium tetrachloride . 2-methyl benzoate and hafnium tetrachloride . 2-ethyl benzoate have been prepared and characterized. Heats of solution of hafnium tetrachloride, zirconium tetrachloride, methyl benzoate, ethyl benzoate, phenyl benzoate, and the new compounds in nitrobenzene have been determined. The heats of formation of the new compounds have been determined.

433. HUMPHREY, G. L. Heats of Formation of Hafnium Oxide and Hafnium Nitride. Jour. Am. Chem. Soc., vol. 75, 1953, p. 2806.

The heats of formation of hafnium oxide and hafnium nitride were determined by combustion calorimetry to be $\Delta H_{298\cdot16} = 266{,}060 \pm 280$ and $\Delta H_{298\cdot16} = 88{,}240 \pm 340$ cal./mole, respectively.

HUMPHREY, M. See abs. 429.

HUMPHREYS, I. B. See abs. 417.

434. HUNHAM, H. S., AND FRED, M. Determination of Tantalum, Zirconium, and Hafnium in Columbium by the Porous Graphite Method. Argonne Nat. Lab., Mar. 14, 1945, 9 pp. AECD-3102.

The methods described were developed to help resolve an apparent discrepancy between values for the neutron absorption cross section of columbium as measured by the 'activation' and the 'danger' methods. To evaluate the effect of impurities in the columbium samples used for the nuclear measurements, quantitative analyses for certain elements were necessary. The porous graphite method was adopted because the samples consisted of different types of columbium compounds and the use of a solution method made a separate calibration for each type unnecessary. The sensitivity so obtained was insufficient for this purpose in the case of tantalum, and a procedure for concentrating the tantalum was developed.

435. HUNTER, M. A., AND JONES, A. Reduction of Some Rarer Metal Chlorides by Sodium. Trans. Am. Electrochem. Soc., vol. 44, 1923, pp. 23-30.

The success that had attended the production of metallic titanium led to the belief that other metals might be prepared in coherent form by reducing their anhydrous chlorides by sodium. The method has been tried out with the chlorides of beryllium, chromium, uranium, vanadium, and zirconium with varying degrees of success. The main difficulty lies not in the reduction itself but in securing enough of the anhydrous chlorides to reduce. If enough of the chlorides were available it is probable all of the metals mentioned could be obtained in metallic form. With the limited quantities of the chlorides that have been prepared on a laboratory scale, beryllium, chromium, and zirconium have been obtained in a more or less granular form, but with uranium and vanadium, metallic powders only with varying degrees of purity have been produced. Further details for each metal are given under the headings of the separate metals.

436. HURD, C. B., FALLON, W. A., AND HOBDAY, R. W. Studies on the Hydrogel of Zirconia. The Time of Set. Jour. Am. Chem. Soc., vol. 64, January 1942, pp. 110-114.

Hydrogels of zirconia have been prepared by mixing solutions of sodium carbonate or sodium acetate and zirconium

Generated on 2024-09-20 18:03 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

oxychloride. This raises the pH of the latter solution from 0.1, where it does not set, up to values from 2.0 to 5.0. The time of set was found in terms of temperature, pH, and concentration of added electrolyte. The energy of activation varied from 21,000 to 29,000. The gels are softer than corresponding silicic acid gels, show some syneresis, but do not hold their form. Gels that have formed at 25° in a few minutes were found to reliquefy at constant temperature in a few hours. Raising the temperature to 60° caused regelation and subsequent cooling caused reliquefaction. The process may be repeated. The time of set is very much decreased by adding potassium chloride in low concentrations to the mixture. A theory for the setting process involving condensation of zirconyl hydroxide is suggested. The amphoteric nature of zirconyl hydroxide makes this possible.

HURFORD, W. J. See abs. 299, 300.

437. HURLEY, P. M., AND FAIRBAIRN, H. W. Alpha-Radiation Damage in Zircon. Jour. Appl. Physics, vol. 23, No. 12, December 1952, p. 1408.

The mineral zircon ($ZrSiO_4$) may contain uranium as a substitution solid solution up to about 0.1 percent and a similar amount of thorium. Several times as much uranium and thorium may be contained by the zircon in the form of small crystal inclusions. The age of individual samples may be estimated from their geological occurrence or measured directly by decay product ratios. All natural zircons show some degree of radiation damage. The determination of the total alpha-bombardment by measurement of present alpha-activity and age may be correlated with the amount of damage and provide information on the damage process.

438. HYDE, E. K. Half-Life of Zr^{88}. Phys. Rev., vol. 92, No. 4, Nov. 15, 1953, p. 927.

The half-life of Zr^{88} has been determined to be 85 days by following the growth and decay of its 105-day Y^{88} daughter.

439. HYDE, E. K., AND O'KELLEY, G. D. Radiochemical and Spectrometer Studies of Several Neutron-Deficient Zirconium Isotopes and Their Decay Products. Radiation Lab., University of California, UCRL-1064, Dec. 28, 1950, 21 pp.

Radioactive zirconium isotopes of mass number <90 have been prepared by bombardment of columbium (niobium) with 100 Mev protons. These isotopes and their decay products have been extensively studied in the beta ray spectrometer and by radiochemical methods. Zr^{87} is shown to be a 94 ± 6 minute activity emitting positrons of 2.10 ± 0.02 Mev energy and decaying into Y^{87m}. Accompanying its 14 hour decay into Y^{87}, Y^{87m} has a complex gamma ray spectrum. The most prominent conversion electrons correspond to a 0.389 ± 0.004 Mev gamma-ray. Y^{87} decays by orbital electron capture into Sr^{87m}, which isotope decays by emission of a 0.394 ± 0.004 Mev gamma-ray with a 2.80 ± 0.03 hour half-life into stable Sr^{87}. Zr^{86} is a 17 ± 2 hour orbital electron capturing isotope decaying into Y^{86}, which in turn disintegrates into stable Sr^{86} with a half-life of 14.6 ± 0.2 hours by the emission of positrons. This positron spectrum is complex, with two components of approximately equal intensity. The energies are 1.80 ± 0.02 Mev. The latter appears to have a forbidden Fermi-Kurie plot corresponding to first forbidden transition with a spin change of two units and a change of parity. The energy of the Zr^{89} position is redetermined at 0.910 ± 0.010 Mev. Conversion electrons corresponding to previously unreported gamma-rays of energy 0.027, 0.396, 0.917, and 1.27 Mev are observed. Preliminary evidence for Zr^{88} is presented which indicates that this isotope decays by the capture of orbital electrons with a half-life of the order of months into a 105 day Y^{88}. Conversion electrons of 0.406 Mev gamma-ray are prominent in the decay of Zr^{88}.

Generated on 2024-09-20 18:11 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

IDDINGS, G. M. See abs. 420.

IKAWA, M. See abs. 762, 763.

440. ILLINGWORTH, F. Nepheline Syenite and Iron Ore Deposits in Greenland. Min. Mag., vol. 84, No. 1, January 1951, pp. 24-27.

A brief discussion of the results of recent exploration for minerals in Greenland.

441. IPATIEFF, V. N., MONROE, G. S., FISCHER, L. E., AND MEISINGER, E. E. Decomposition of Alcohols Over Nickel-Kieselguhr and Other Catalysts. Ind. Eng. Chem., vol. 41, No. 8, August 1949, pp. 1802-1805.

Primary alcohols undergo cleavage in the presence of nickel-kieselguhr catalyst at atmospheric and 35 atmospheres of pressure to yield, as a major product, hydrocarbons having one carbon atom less than the parent alcohols. The reaction is assumed to involve conversion to the aldehyde followed by elimination of carbon monoxide to produce the paraffin. The influence of different factors on the decomposition of primary alcohols was studied with n-butyl alcohol. Pressure suppresses the decomposition. The effect of catalyst composition is marked, substitution of part of the nickel with other metals or oxides resulting in a decreased yield of propane or in an alteration of the type of product formed. A silica-alumina-zirconia was studied also.

442. IRON AGE. Rare Metals Improve Magnesium Alloys. Vol. 162, No. 4, July 22, 1948, p. 83.

Two new alloys of magnesium in the form of extrusions, forgings, and castings, offering high strength, toughness, and resistance to creep at high temperatures, have been developed by Dow Chemical Co., Midland, Mich. Small contents of zirconium or cerium are primarily responsible for their improved properties. Additions of zirconium to magnesium alloys are effective in developing and maintaining a fine-grain structure and make it possible to hold the iron content to a very low level, thereby improving the resistance of these magnesium alloys to atmospheric corrosion.

443. ISHII, R. /Practical Method of Determining Zirconium Present as the Metal, Oxide, Nitride and Carbide in Commercial Samples of Zirconium Metal./ Phys. Chem. Res. (Tokyo), vol. 41, No. 1140, August 1943, 21 pp.

It has been found that the metal and oxide of zirconium contained in a sample of commercial zirconium metal can be separated from each other by means of hydrofluoric acid and that the method is of much practical use, though not quantitatively perfect in the strict sense. Also, it was noted that the behavior of carbide of zirconium towards hydrofluoric acid is similar to that of the oxide; that there are probably two kinds of zirconium nitride, one being soluble in hydrofluoric acid and the other, inaqua regia like the carbide and unlike the oxide; and that these facts have made it possible to determine the metal, oxide, carbide, and nitrides contained in a sample of zirconium metal.

444. IVES, H. E., KINGSBURY, E. F., AND KARRER, E. Physical Study of the Welsbach Mantle. Jour. Franklin Inst., vol. 186, No. 4, October 1918, pp. 401-625. Pres. by Doctor Ives at a meeting of the Sec. Phys. and Chem., Thursday, Jan. 10, 1918.

The investigation described, insofar as it deals with the radiating characteristics of the incandescent mantle, constitutes chiefly an extension of the work of Rubens on the thoriaceria mixtures to a large family of such combinations. It exhibits the Welsbach mantle of commerce simply as one of a group of possible combinations of radiating materials, behaving according to the same general laws but remarkable among them for the degree to which the characteristics of selective radiation are exhibited.

Generated on 2024-09-20 18:19 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

445. IVORY, W. /Manufacture of Zirconium-Potassium Fluoride, Zirconium Oxide, and Zirconium Oxychloride./ British Intelligence Objectives Sub. Comm., BIOS-896 (undated), 6 pp.

This report gives a short account of the method of manufacture of zirconium-potassium fluoride, zirconium oxide, and zirconium oxychloride as carried out in the Auergesellschaft Aktiengesellschaft, Berlin. Where possible quantities, times, and temperatures are given, and the percentage recovery of zirconium from the ore is included.

JACKSON, D. H. See abs. 917.

JACKSON, D. R. See abs. 891.

446. JACKSON, F. G., AND SHAW, L. I. Purification and Analysis of Zirconium Dioxide. Jour. Am. Chem. Soc., vol. 44, June 1922, pp. 2712-2714.

Zirconia is best dissolved by fusion with a mixture of borax and soda. The fusion, when taken up in dil. hydrochloric acid, cannot be separated from insoluble residue by direct filtration. It was found that by precipitating the hydroxide, the residue is entangled and can then be filtered and washed. The hydroxide can then be dissolved on the filter and filtered clear by repeatedly pouring the filtrate through the precipitate. A very little sulfuric acid added to this filtrate precipitated very gelatinous zirconium basic sulfate, which, however, could be coagulated by heating nearly to boiling and then filtered and washed free from iron and aluminum. Titanium was also precipitated as basic sulfate and could not be removed to any great extent. The process, although complicated and slow, seems to be efficient in removing iron, alumina, and silica.

JACKSON, M. See abs. 793.

447. JACOBS, A., MASTELLER, R. D., AND BEYER, G. H. Development of a Process for the Production of a High Hafnium Concentrate. Ames Lab., Iowa State College, ISC-140, June 1, 1951, 33 pp.

Four experimental runs were made with a view to developing a method of producing high hafnium concentrates. Each of these runs consisted of the adsorption of hafnium and zirconium tetrachlorides (or complexes) by silica gel from methanol solution and the subsequent differential stripping of the gel using a methanol-hydrogen chloride strip of solution and a final sulfuric acid strip solution.

JACOBS, F. M. See abs. 89.

JACOBSON, L. See abs. 343, 800.

448. JACOBSON, L., AND OVERSTREET, R. Mass Assignment of the Chain 65d Zr^{95}-35 Nb^{95} and Notes on Other Niobium Activities; chap. in Radiochem. Studies: The Fission Products, Nat. Nuclear Energy Series. McGraw-Hill Book Co., Inc., book 2, vol. 9, No. 5, New York, N. Y., 1951, pp. 735-745.

A radiochemical study was made of columbium (niobium) activities produced by deuteron bombardment of molybdenum and zirconium and fast-neutron irradiation of columbium for checking the mass assignment of the 35d Nb^{95} from fission. In addition, evidence was obtained that the 60d Cb has a mass assignment of 91, clarifying certain previous transmutation studies, and that the 18h Cb positron emitter is Cb^{90}. A 78h Cb, presumably Cb^{95m}, was also observed. No evidence was obtained for Cb^{92} or Zr^{93} of half-life between a few hours and 1 year.

449. JAEGER, F. M., AND VEENSTRA, W. A. Exact Measurement of the Specific Heats of Solid Substances at High Temperatures - The Colorimetrical Behavior of Zirconium. Rec. trav. chim., vol. 53, 1934, pp. 917-932.

The authors investigated the behavior of zirconium when it was heated in the macrocrystalline state and in the pulverized condition. A well-defined reversible allotropic change is doubtlessly

Generated on 2024-09-20 18:05 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

observed with a true inversion - temperature (under a pressure of 1 atmosphere) at about 870° C. Examination of the retardation phenomena indicates that between 400° and 630° C. even the crystals of ductile zirconium are not in a state of complete internal equilibrium. A theory is given to explain the retardation phenomenon.

450. JAFFEE, R. I. Putting the Uncommon Metals to Work. Battelle Tech. Rev., vol. 1, November-December 1952, pp. 126-127.

A general discussion of the uncommon metals from the standpoint of demands, requirements and unique properties.

JAMES, C. See abs. 733.

JAMISON, H. W. See abs. 878.

451. JEFFERY, W. C. Zirconium for Manganese in Cupola Iron. Metal Progress, vol. 60, No. 2, August 1951, pp. 65-66.

It has been found that the substitution of zirconium for manganese in cast iron results in a more machinable product with better physical properties. Also, it has been proved that this can be accomplished economically.

JESSUP, A. C. See abs. 195.

452. JOHNSON, G., AND WEYL, W. A. Influence of Minor Additions on Color and Electrical Properties of Rutile. Jour. Am. Ceram. Soc., vol. 32, No. 12, December 1949, pp. 398-401.

In connection with some work on the color of minerals, it was found that the presence of Ti^{3} + in rutile can originate from two basically different causes. The bluish color of certain rutile preparations owing to the presence of the Ti^{3} + ion of Ti_2O_3 is the result of (1) reducing conditions causing an oxygen deficiency in the rutile lattice or (2) the presence of cations having a valency higher than four. Replacing a tetravalent titanium ion by a pentavalent ion, for example, Sb^{5} +, forces another titanium ion into the trivalent state in order to maintain the electroneutrality of the lattice. The presence of ZrO_2 in TiO_2 makes the rutile more susceptible to certain impurities in its lattice, thus enhancing discoloration. The value of these crystal-chemical considerations for the opacification of enamels and the dielectric properties of ceramic bodies containing rutile or rutile-zirconia mixed crystals is pointed out.

JOHNSON, G. W. See abs. 52.

JOHNSON, J. S. See abs. 499.

453. JOHNSON, P. D. Behavior of Refractory Oxides and Metals, Alone and in Combination, in Vacuo at High Temperatures. Jour. Am. Ceram. Soc., vol. 33, No. 5, May 1950, pp. 168-171.

Changes in bulk density, shrinkage, and weight are given for carbon and for dry-pressed specimens of beryllia, magnesia, zirconia, thoria, molybdenum, and tungsten when fired for 2, 4, and 8 minutes under vacuum conditions, using 100° C. increments in the temperature range 1,500° to 2,300° C. Temperatures at which instability of surface-to-surface contact was observed for the 21 possible binary systems of the foregoing substances are also described for identical conditions of testing.

See also abs. 93.

JOHNSON, R. A. See abs. 497.

JOHNSON, R. L. See abs. 689.

454. JOHNSON, W. A. Metals for Atomic Reactors. Products Eng., vol. 24, No. 12, December 1953, pp. 292, 294, 296. Pres. at 2d Ann. Conf., Atomic Energy in Industry, Natl. Conf. Board, New York City, Oct. 29, 1953.

Resistance to radiation damage, ductility, corrosion resistance, and strength are among the properties that

Generated on 2024-09-20 18:02 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

make the new metals, including zirconium, of extreme importance to the atomic reactor program.

455. JOHNSON, W. V. New Metals in Atomic Energy. Steel Process., vol. 39, No. 12, December 1953, pp. 659-663.

In this discussion of the three most important new metals that have received attention as a result of potential atomic energy applications, indications are given of the progress that has been made in developing their metallurgy and their need in connection with power reactor needs.

JOHNSTON, H. L. See abs. 827.

JOHNSTONE, H. F. See abs. 649.

456. JONASSEN, H. B., AND deMONSABERT, W. R. Inorganic Complex Compounds Containing Polydentate Groups VIII. Zirconium (IV) Complexes with 2-Nitroso-1-Naphthol. Jour. Am. Chem. Soc., vol. 74, No. 21, Nov. 5, 1952, pp. 5298-5301.

The complexes formed between 2-nitroso-1-naphthol and zirconium have been investigated in mixtures of water and ethanol and water and dioxane in the absence and presence of $HClO_4$. It has been found that in the absence of $HClO_4$, a one-to-one complex forms, whereas in solutions 3 M or larger in $HClO_4$ and 3 x 10^{-3} M Zr a one-to-four complex is formed. The pK instability values have been determined: For the one-to-one complex in ethanol-water it is 3.7 and for the one-to-four complex in 50 percent dioxane-water it is 11.6.

JONES, A. See abs. 435.

JONES, E. W. See abs. 374.

JONES, H. E. See abs. 131.

457. JONES, O. A. Factors Controlling the Occurrence of Heavy Mineral Beach Sand Along the Queensland and New South Wales Coasts. Australasian Eng., vol. 45, July 7, 1953, pp. 43-45.

Discussion of the minerals rutile, zircon, ilmenite, and their occurrences. Distribution, veins, concentration on beaches, etc. are discussed from the standpoint of geology.

458. JONES, R. G. Organometallic Compounds of Titanium, Zirconium, and Lanthanum. Jour. Sci., vol. 17, 1942, pp. 88-90.

To extend the usefulness of organometallic compounds as synthetic tools in organic chemistry, it is important that new RM types be synthesized. Comparatively few studies on the organometallic compounds of the transition metals have been reported. A review was made of all methods of preparing organometallic compounds and then several of the general methods were applied to three typical transition metals, titanium, zirconium, and lanthanum. Although the desired RM derivatives were not obtained some interesting observations were made on the reactions of the titanium, zirconium, and lanthanum halides with RMgX and RLi compounds.

JORDAN, C. B. See abs. 184.

JOSEPH, W. See abs. 720, 721.

KAHN, N. A. See abs. 11

459. KALISH, H. S. Latest Developments in Zirconium. Materials and Methods, vol. 37, No. 5, May 1953, pp. 174, 176, 178, 180, 182, 184, 186, 188.

The use of zirconium up to a few years ago has been largely limited to its incendiary nature when finely divided, for example in photoflash lamps and flares, or for its lettering qualities, but the great future use is based on its corrosion resistance and other properties, making it a most favorable material for the chemical industry and in the construction of nuclear reactors. The role zirconium is expected to play in the family of metals was discussed at the Western Metal Congress in Los Angeles,

Generated on 2024-09-20 18:04 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Mar. 23-27, 1953, and is covered in this article.

See also abs. 357, 358, 359, 360.

460. KALISH, H. S., HAUSNER, H. H., AND ANGIER, R. P. Physical Properties of Sintered Zirconium. Sylvania Elec. Prod., Inc., SEP-44, Mar. 30, 1951, 31 pp.

It is shown that zirconium is a most suitable metal for powder metallurgical applications, and that the use of zirconium hydride powder in the fabrication techniques has many advantages over the use of zirconium powder. The pressing and sintering conditions for producing zirconium by powder metallurgy were established. Both types of powder were found to compact easily and to sinter at a fairly low temperature to the theoretical density of zirconium. Covered graphite boats were used during sintering. When sintered at 1,150° to 2,500° C. in vacuum, zirconium hydride powder decomposes to metallic zirconium, and this formation of the metal during an earlier stage of sintering results in a high activation of the particles which permits sintering to the theoretical density in fairly short times and at low temperatures. The properties of sintered zirconium were investigated. The studies included the ultimate density of sintered zirconium as a function of compacting pressure, a correlation of grain growth with densification and the factors affecting hardness and resistivity of the sintered product. Sintered zirconium was found to have good ductility.

KAPLAN, M. See abs. 343.

461. KAR, H. A. Electrolytic Determination of Titanium, Zirconium or Aluminum in Chromium Steels and Alloys. Metals and Alloys, June 1935, pp. 156-157.

An electrolytic method has been developed for determining titanium, zirconium, or aluminum in chromium steels and alloys. By electrolysis the interfering elements are deposited, whereas titanium, zirconium, and aluminum, if present, are left in solution.

KARRER, E. See abs. 444.

462. KATCOFF, S., AND FINKLE, B. Energies of Radiations of 17th Zr^{97} and 75m Nb^{97}; chap. in Radiochem. Studies: The Fission Products, Nat. Nuclear Energy Series. McGraw-Hill Book Co., Inc., book 2, vol. 9, No. 5, New York, N. Y., 1951, pp. 705-708.

The maximum β energies of 17th Zr^{97} and 75m Nb^{97} as obtained by Feather analysis of the aluminum absorption curves are 2.2 and 1.4 Mev, respectively. The γ energy as determined from a lead absorption curve is about 0.8 Mev for both species.

463. KATCOFF, S., FINKLE, B., AND HOAGLAND, E. J. Note on Analytical Methods for the Determination of Short-Lived Zirconium and Niobium Activities in Fission; chap. in Radiochem. Studies: The Fission Products, Nat. Nuclear Energy Series. McGraw-Hill Book Co., Inc., book 3, vol. 9, No. 6, New York, N. Y., 1951, pp. 1510-1511.

Samples of zirconium and columbium (niobium) that were separated from uranyl nitrate soon after irradiation showed the presence of contaminating activities. The half-life of the zirconium contaminant is 40 to 60 hr. and the half-life of the columbium contaminant is 70 to 80 hr. The niobium contaminant was shown to be a mixture of 77h Te and 67h Mo; it was successfully removed by specific scavengings. The zirconium contaminant is probably 2.3d Np^{239}.

KATO, W. Y. See abs. 423.

KATZ, J. J. See abs. 315, 316, 407.

464. KATZ, M., AND HALPERN, S. Oxidation of Carbon Monoxide in Air by Silver Permanganate. Ind. Eng. Chem., vol. 42, No. 2, February 1950, pp. 345-352.

Generated on 2024-09-20 18:03 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The oxidation of carbon monoxide in an air stream by silver permanganate on weakly basic and acidic metallic oxide carriers takes place readily at ordinary temperature. Rapid oxidation at high space velocity in the catalytic bed occurs with silver permanganate in the presence of coactivators such as CuO, ZnO, CdO, Al_2O_3, $Al_2O_3.2SiO_2.2H_2O$, TiO_2, ZrO_2, SnO_2, Pb_3O_4, V_2O_5, Sb_2O_3, MoO_3, MnO_2, Fe_2O_3, Co_2O_3, and CeO_2. The following relations have been studied. The escaping concentration from the reacting bed as a function of time, flow rate, column length and initial concentration; the influence of size of granules; the effect of relative humidity of air stream and moisture content of granules; and the relation between activity and mole composition. The kinetics of oxidation agree with the assumption that the rate is proportional both to the concentration of gas in the stream and to the concentration of 'active centers.' Catalytically active centers do not retain their activity indefinitely but become used up or poisoned with time. Theoretical treatment is similar to that of irreversible absorption of gas on solid absorbents.

465. KAUFFMAN, A. J. Zirconium and Hafnium-Bearing Zirconium Mineral Occurrences. Bureau of Mines, November 1951, 11 pp. (Unpublished report to Atomic Energy Comm., Pittsburgh, Pa.)

A discussion of world-wide zircon and hafnium-bearing zirconium minerals.

KAUFFMAN A. R. See abs. 364, 559, 852, 853.

466. KAWIN, B., COPP, D. H., AND HAMILTON, J. G. Studies of the Metabolism of Certain Fission Products and Plutonium. Radiation Lab., University of California, UCRL-812, Aug. 7, 1950, 120 pp.

The distribution and excretion of radioisotopes of cerium, columbium, plutonium, strontium, yttrium, and zirconium has been studied in adult female rats of the Long-Evans strain. The metabolism of Pu(VI) was unaltered by general treatment with the sulfhydryl compounds, 2,3-dimercaptopropanol (BAL) and cysteine. This suggests that the metabolism of plutonium is not related to that of sulfhydryl groups. These compounds do not appear to have use as therapeutic agents for plutonium poisoning. Cysteine appeared to increase the amount of plutonium retained at the site of intramuscular injection. Parathormone had no significant effects on the distribution and excretion of either plutonium or yttrium. The resorption of bone by parathormone did not appear to labilize these bone deposited elements, nor make them more susceptible to the positive effects of zirconium citrate. Massive doses of zirconium citrate appeared to have some positive effects on the distribution and excretion of cerium, columbium, plutonium, and yttrium. Sodium citrate had relatively little effect on the metabolism of these elements, with the exception of yttrium. Both citrates were without significant effect on the metabolism of radiostrontium. Zirconium citrate may alter the metabolism of the several radioisotopes through a 'carrier' action as a chelated radiocolloidal citrate complex. The possible influence of this complex on the uptake and excretion of the several radioisotopes during the first hour following their administration has been discussed.

467. KAY, F. D. Electrostatic Separation. Min. Cong. Jour., vol. 35, No. 8, August 1949, pp. 26, 27, 51.

Some important factors are given in the separation of rutile and zircon.

KEAR, R. W. See abs. 410.

KEELER, J. H. Development of Zirconium Base Alloys. See abs. 388.

_____. Development of Zirconium Base Alloys. See abs. 389.

_____. Development of Zirconium Base Alloys. See abs. 390.

Generated on 2024-09-20 18:02 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

KEELER, J. H. Development of Zirconium Base Alloys. See abs. 391.

_____. Development of Zirconium Base Alloys. See abs. 393.

_____. Development of Zirconium Base Alloys. See abs. 394.

_____. Development of Zirconium Base Alloys. See abs. 395.

_____. Development of Zirconium Base Alloys. See abs. 396.

468. _____. Tensile Characteristics of Unalloyed Zirconium at Low and Moderate Temperatures. G. E. Co., Research Lab., May 1953, 42 pp. SO-2510.

The influence of strain rate, test temperature, strain, recrystallized grain size, texture, and small amounts of oxygen-nitrogen impurity on true stress versus true strain characteristics and on engineering properties of unalloyed (arc-melting) zirconium has been described. The behavior of severely cold-reduced zirconium at and above 200° C. seemed to be related in some manner to recovery, stress recovery, and strain aging. A yield point was observed and found to decrease in degree with increased grain size and with decreasing temperature.

KEELER, J. J., HIBBARD, W. R., JR., AND DECKER, B. F. Development of Zirconium Base Alloys. See abs. 392.

469. KEIN, C. P., NORMAND, C. E., AND WEAVER, B. Electromagnetically Enriched Isotopes. Carbide and Carbon Chem. Corp., Inventory, Sept. 30, 1951, 71 pp. Y-819.

This inventory lists the isotopes that have been concentrated electromagnetically, along with the completed information on their enriched abundances and the element weights and product forms available in milligram quantities to users on Atomic Energy Commission projects and in university and industrial laboratories.

470. _____. Electromagnetically Enriched Isotopes. Carbide and Carbon Chem. Co., Inventory, May 31, 1953, 44 pp. ORNL-1568.

This inventory lists the isotopes that have been concentrated electromagnetically, along with the completed information on their enriched abundances and the element weights and product forms available in milligram quantities to users on Atomic Energy Commission projects and in university and industrial laboratories.

471. KELLEY, K. K. Contributions to the Data on Theoretical Metallurgy. VII. The Thermodynamic Properties of Sulfur and Its Inorganic Compounds. Bureau of Mines Bull. 406, July 1936, 154 pp.

This bulletin has as its primary purpose the correlation of the thermodynamic properties of elementary sulfur and its inorganic compounds and the presentation, after careful consideration of all available information, of a self-consistent system of thermodynamic relationships for these substances.

472. _____. Entropies of Inorganic Substances. Bureau of Mines Bull. 350, 1932, 63 pp.

A survey of thermodynamic data on substances important to metallurgy. This work is a collection of such data and a discussion thereof.

473. _____. Specific Heats at Low Temperatures of Ferrous Silicate, Manganous Silicate and Zirconium Silicate. Jour. Am. Chem. Soc., vol. 63, October 1941, pp. 2750-2752.

Specific heat measurements of Fe_2SiO_4, $MnSiO_3$, and $ZrSiO_4$ have been made in the temperature range 51 to 298° K. Fe_2SiO_4 has a marked maximum in its specific heat curve, with the peak at 65.0° K. The entropies at 298.16° K. are 35.4 ± 1.4 for Fr_2SiO_4, 21.3 ± 0.3 for $MnSiO_3$, and 20.1 ± 0.3 for $ZrSiO_4$. The free energies

Generated on 2024-09-20 18:03 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

of formation from the elements have been computed for $MnSiO_3$ and Fe_2SiO_4 as, respectively, $\Delta F°$ 298.6 = -282,100 and $\Delta F°$ 298.16 = -324,800.

474. KELLOGG, H. H. Metallurgical Reactions of Sluorides. Jour. Metals, vol. 191, February 1951, pp. 137-141.

Graphs representing the standard free-energy of formation as a function of temperature for 21 fluorides are presented, along with estimated values for the standard free-energy of formation of 20 additional fluorides. Discusses a few of the many possible uses of these data in metallurgical calculations, including the fluorination of oxides, sulfides, and chlorides and the reduction of metal fluorides.

475. KELLOGG, H. H., AARON, D., BENEDICT, J. T., AND HOWELL, L. J. Study of the Electrodeposition of Zirconium From Fused Salts, Progress Report No. 1. Columbia University School of Mines, November 1951, 13 pp. NYO-3106.

The purposes of the research to be carried out under this contract are: To discover a molten-salt electrolyte suitable for the electrolytic production of zirconium metal. To make a variety of physical-chemical measurements on the behavior of this electrolyte in order to understand the problems that must be met to develop a successful deposition of zirconium metal. This report consists of a general discussion of the plan of attack that will be followed and experimental methods that will be used.

476. KELLOGG, H. H., BENEDICT, J. T., AND HOWELL, L. J. Electrolytic Production of Zirconium Metal, Progress Report No. 2. Columbia University, Aug. 31, 1952, 30 pp. NYO-3107.

Preliminary experiments on the phase diagram and vapor pressure of melts in the system $ZrCl_4$ - NaCl are described. The design of equipment for electrolytic conductivity, phase diagram, and vapor pressure measurements on fused melts containing $ZrCl_4$ is described.

477. KELLOGG, M. W. Report on Ceramics. M. W. Kellogg Co., 1948, 49 pp. NP-689.

The material contained in this report has been extracted from the M. W. Kellogg Co's. monthly progress reports, entitled "6,000-Pound Thrust Jet Propulsion Unit." It includes a literature survey on ceramics and a discussion of a high-temperature electric torch and refractories with zirconium dioxide base.

KENAHAN, C. B. See abs. 779.

478. KENDALL, J., AND WEST, W. Attempted Separation of Hafnium and Zirconium by the Ionic Migration Method. Jour. Am. Chem. Soc., vol. 48, October 1926, pp. 2619-2626.

The method of ionic migration has been applied to the separation of zirconium and hafnium. After prolonged electrolysis of an agar gel containing these elements as complex anions, a slight but nevertheless distinct concentration of hafnium in the rear of the section occurred, a difference of some 2 percent in the average atomic weights of front and rear segments being consistently established. The degree of separation, however, was much smaller than that previously attained in the application of the method to the rare-earth metals. An attempt is made to correlate the similarity of the velocities of zirconium and hafnium ions, contrasted with the considerable differences that apparently exist in the rare-earth group, with prevalent nations of the atomic structures of the elements in question.

KHYM, J. X. See abs. 888.

479. KIEFER, E. W., AND BOLTZ, D. F. Spectrophotometric Determination of Zirconium. Anal. Chem., vol. 24, No. 3, March 1952, pp. 542-544.

The need for a method of determining small amounts of zirconium prompted this investigation, the ultimate objective

Generated on 2024-09-20 18:08 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

being the development of a spectrophotometric method. It was found that zirconium could be precipitated by adding a standard phosphate solution and that the concentration of the supernatant phosphate solution following centrifugation decreased in proportion to the amount of zirconium present. The phosphate was determined spectrophotometrically as the molybdiphosphoric acid complex. The concentration range is 1 to 80 p.p.m. of zirconium using 1-cm. cells. The recommended general procedure should be valuable to those concerned with the microdetermination of zirconium.

480. KIEFER, R., AND KOLBL, F. Tungsten Carbide-Free Hard Metals. Powder Met. Bull., vol. 4, No. 1, January 1949, pp. 4-17.

Hard alloys containing no metal carbides are only of rather limited usefulness. Tungsten carbide can, however, successfully be replaced by metal carbides of the 4th, 5th, and 6th group of the periodic system. The inexpensive titanium carbide appears most suited as main constituent of tungsten-free cemented carbides. The carbides of vanadium, columbium, and molybdenum, which all are readily sintered, appear most interesting as additional carbides. For applications as tool materials, the minimum requirements for hardness and transverse rupture strength are 88-90 Rockwell A and 105,000-135,000 p.s.i., respectively, according to the material to be machined and the machining conditions. Lower strength values are permissible for a number of applications as wear-resistant materials. Matching of cast iron and rock drilling, on the other hand, requires markedly higher transverse rupture values, which in combination with the required hardness can apparently not be reached by WC-free hard metals. Production of WC-free hard metals by hot pressing gives more satisfactory results than cold pressing and subsequent sintering in either hydrogen or vacuum. Vacuum sintering is preferable to sintering in hydrogen.

KIESS, C. C. See abs. 592.

481. KIESSLING, R. Binary System Zirconium-Boron. Inst. Chem., University Uppsala, Sweden, January 1949, pp. 90-91.

As a part of a study of binary systems, composed of a transition element and boron, the zirconium-boron system has been investigated by X-ray methods. Certain studies on alloys between these elements have been reported. The phases, however, do not seem to be pure. McKenna has found a boride of the composition ZrB_2[3], which is discussed.

KILLEN, A. S. See abs. 670.

482. KING, B. W., AND ANDREWS, A. I. Solubility of Zirconia in Soda-Borosilicate Glasses. Jour. Am. Ceram. Soc., vol. 24, No. 11, 1941, pp. 367-372.

The solubility of zirconia at 1,500° and at 2,200° F. was determined for glasses containing Na_2O, B_2O_3, Al_2O_3, and SiO_2. The solubility at these some temperatures was also determined for glasses containing equal parts of boric oxide and silica and one or more of the following constituents in quantities of 10, 20, or 30 percent: Li_2O, Na_2O, K_2O, MgO, CaO, SrO, BaO, ZnO, Al_2O_3, CaF_2, and Na_3AlF_6.

483. KING, H. G., AND OWENS, W. H. Colorimetric Determination of Zirconium. Carbide and Carbon Chem. Corp., Oct. 27, 1952, 10 pp. Y-917; AECD-3491.

An adaptation of the alizarin lake method for determining zirconium in the presence of uranium is presented. The method depends largely upon the purification procedure, which assures the removal of common interferences. Fluoride and phosphate are removed by volatilization, and sulfate effect is eliminated by calcium chloride. Uranium is oxidized to U(VI), and does not interfere at the wave-length utilized. Impure solutions may be analyzed quite rapidly with accuracy of within ± 20 percent.

Generated on 2024-09-20 18:10 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

KINGERY, W. D. See abs. 430, 652, 653, 654, 655, 656, 657, 659, 660.

484. KINGERY, W. D., ECONOMOS, G., HUMENIK, M., JR., AND BERG, M. Development of Metal-Ceramic Compositions Suitable for Service at Elevated Temperatures. Massachusetts Inst. Technol., MIT-56, April 1950, 6 pp. NEPA-1435.

A method of calculating approximate surface energies on simple theoretical grounds is described and sample calculations for copper, lead, and sodium chloride are given. Measurements of contact angles of copper with alumina, stabilized zirconia, and graphite are reported. Values varied considerably between hydrogen and vacuum. Plaques and covers have been prepared from alumina and stabilized zirconia for studying metal-ceramic reactions. Sodium chloride has been selected as a model material for the study of metal-ceramic sintering. Some spherical particles have been formed. Some preliminary measurements of the effect of forming pressure on green density and the sintering rate of pressed pieces have been made.

485. _____. Development of Metal-Ceramic Compositions Suitable for Service at Elevated Temperatures. Massachusetts Inst. Technol., MIT-57, May 1950, 6 pp. NEPA-1449.

In the study of metal-ceramic wettability, contact angles have been determined for bismuth on molybdenum silicide, nickel on graphite, and beryllium on alumina. Approximate calculations of surface tension for the metals considered have been made. Firing of titanium, silicon, zirconium, molybdenum, columbium (niobium), and nickel to 1,825° C. in contact with alumina and stabilized zirconia has been completed with preliminary observations. Certain free energies of oxidation-reduction for the metals and oxides have been calculated from thermodynamic data. The preliminary study of sintering of sodium chloride and sodium chloride-metal combinations has been continued using powder compacts in place of pressed disks.

KINGSBURY, E. F. See abs. 444.

486. KINZIE, C. J., AND COMMONS, C. H., JR. Effect of Various Zirconium and Titanium Compounds on a Glaze. Bull. Am. Ceram. Soc., vol. 16, No. 1, January 1937, pp. 1-4.

The purpose of this study was to determine the specific effects and limiting factors of various zirconium compounds on a glaze. The work was extended to include titanium compounds.

487. _____. Effect of Zirconium Oxide in Glasses, Glazes, and Enamels. Jour. Am. Ceram. Soc., vol. 17, 1934, pp. 283-287.

Zirconium oxide has been used successfully as an opacifying agent in enamels and glazes for some time, but its effect on the physical properties of the glass have only recently begun to be appreciated. For the purpose of this discussion its effects have been classified into two groups, (1) opacity and (2) other physical properties.

KIRICHENKO, O. I. See abs. 694.

488. KIRSHENBAUM, A. D., MOSSMAN, R. A., AND GROSSE, A. V. Determination of Oxygen in Titanium and Zirconium by the Isotopic Method. Am. Soc. Metals Preprint 1, 1953, 8 pp.

The quantitative methods for determining the oxygen content of metals such as titanium and zirconium used at present are not very accurate and at times are long and tedious, requiring complete removal and quantitative recovery of oxygen from the metals in the form of a suitable compound. The isotopic method using O^{18} as a tracer does not require quantitative separation or recovery of the oxygen, thus giving accurate results. The only requirement of this method is the exchange of all oxygen atoms in the system, which is accomplished at the high temperatures used. Accurate oxygen

Generated on 2024-09-20 18:06 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

values were obtained by this method for titanium and zirconium metals in the range of 0.3 to 26 percent.

489. KISTLER, S. S. Zirconia - New Refractory Product. Brick and Clay Record, vol. 118, No. 3, March 1951, pp. 57-59.

An important new refractory product, fused stabilized zirconia, was announced recently by Norton Co. A product that promises to open an entirely new era in chemical processing at ultrahigh temperatures, in molded shapes it will withstand temperatures up to 4,600° F., beyond the limit of other commercial oxide refractories. (Fire clay up to 3,000° F., fused alumina up to 3,300° F., pure oxide of magnesia up to 4,000° F.) All the uses to which this product can be put are not yet known. Those that are known include a variety of molded shapes, such as: Furnace lining bricks for gas synthesis at high temperatures in the chemical industry; setter plates for firing titanates used in the construction of capacitors in the electronic equipment field; heating elements for electric furnaces; containers and conveyers for molten steel; and thermal insulation (high-frequency induction or resistor wound furnaces). Papers prepared by research engineers of the Norton Company, explaining the development, properties and uses of stabilized zirconia, are presented.

490. KLEIN, J. R., AND AUSTIN, E. Inhibitory Effect of Aromatic Acids on the D-Amino Acid Oxidase, Inhibition of the D-Amino Acid Oxidase. Brookhaven Nat. Lab., BNL-1482, undated, 18 pp.

Describes the inhibiting effect upon the D-amino acid oxidase of certain acids particularly heterocyclic acids having aromatic properties, for example, acid derivatives of furan, pyrrole, and pyrones. Like the benzoic acids, kojic acid and 4-7 carbon, straight-chain, fatty acids the substances compete with D-amino acids for the oxidase and are in contrast to the aromatic nitrogen compounds that compete with the flavin component of the oxidase. The findings suggest some analogies between the inhibitors and the amino acids that bear upon the interaction of these substances with the oxidase.

KLINGENBERG, J. J. See abs. 664, 674.

491. KLINGENBERG, J. J., AND PAPUCCI, R. A. Determination of Zirconium in Steels Using p-Bromo- or p-Chloromandelic Acid. Anal. Chem., vol. 24, No. 11, November 1952, pp. 1861-1862.

Covers a discussion of the mandelate method and its comparison to the cupferron phosphate method for the direct determination of zirconium in alloy steels. Analyses are included.

492. KNAUFT, R. W. Zircon Refractories for Aluminum Melting Furnaces. Metals and Alloys, vol. 18, December 1943, pp. 1326-1330; Refractories Jour., vol. 20, 1944, pp. 195-200.

Despite the relatively low melting temperatures developed in them, aluminum-melting furnaces present a sizeable refractories problem. Of special interest, therefore, is this report of operating experience in the use of zircon (zirconium silicate) refractories to improve not only hearth life and production rate but also the quality of the metal melted.

KNOWLES, H. B. See abs. 553.

KNOX, W. J., JR. See abs. 234.

493. KNOX, W. J., JR., AND BURBRIDGE, T. N. Vapor Phase Esterification Over Zirconium Oxide. Jour. Am. Chem. Soc., vol. 65, No. 6, June 11, 1943, pp. 999-1001.

The equilibrium of the vapor phase esterification of ethyl alcohol by acetic acid over zirconium oxide has been studied by a static method at 200°, 150°, and 125°. From the data obtained the equilibrium constants and standard free energies for this reaction at these temperatures have been calculated.

Generated on 2024-09-20 18:10 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

494. KOENIG, J. H. Ceramics. Ind. Eng. Chem., vol. 41, January-December 1949, pp. 2102-2108.

This is a general review of the ceramics field today. Data is given on the properties of the classical ceramic bodies. The trend continues toward firing certain ceramics (whitewares) at lower temperatures and developing the ceramic and the glaze or glassy coating in a single firing and also increasing mechanization of the unit operations.

_____. See abs. 836.

495. KOENIG, R. F. Corrosion of Zirconium and Its Alloys in Liquid Metals. Knolls Atomic Power Lab., KAPL-982, Oct. 1, 1953, 14 pp.

Comparatively little study has been made of the behavior of zirconium in liquid metals because the primary interest in zirconium has been for water-cooled reactors. The relatively low elevated temperature strength of zirconium and most of its known alloys make it unsuitable for liquid-metal-cooled reactors intended for high operating temperatures. Some promise of better high-temperature strength is indicated by current alloy development programs. For this reason, zirconium alloys have been included in many exploratory tests in liquid metals.

496. _____. New Tests Prove Materials for Nuclear Power Plants. Iron Age, vol. 172, No. 8, Aug. 20, 1953, pp. 129-133.

Engineers have devised new and more critical methods to test materials for the unique service requirements and extreme reliability required in nuclear power plants. A combination of exceptional mechanical properties and good nuclear characteristics is a must. Corrosion testing in liquid metals is done in progressive stages - static, dynamic, then under conditions to simulate actual service. Some tests must be performed in nuclear reactors, particle accelerators, or atomic piles.

KOJIMI, S. See abs. 762, 763.

KOLBL, F. See abs. 480.

497. KOLTHOFF, I. M., AND JOHNSON, R. A. Amperometric Titrations With m-Nitrophenylarsonic Acid. Jour. Electrochem. Soc., vol. 98, No. 4, April 1951, pp. 138-145.

In connection with the amperometric titrations of metal ions with arsonic acids, the polarography of certain arsonic acids has been studied. The arsonic acids are reduced to substituted arsines in a six-electron reduction. The nitro group of m-nitrophenyl-arsonic acid is reduced in two steps: 1. Nitro to hydroxylamine involving four electrons; and 2. hydroxylamine to amine involving two electrons. The effect of hydrochloric acid concentration on these reductions is discussed. m-Nitrophenylarsonic acid is a suitable reagent for the amperometric titrations of uranyl, thorium, zirconium, and stannic tin ions. The compositions of the precipitates at the end point are UO_2R, ThR_2, ZrR_2, and SnR, respectively (reagent denoted as H_2R). Zirconium first precipitates as the monoarsonate, which is readily transformed into the diarsonate by excess reagent. SnR reacts slowly with an excess of reagent to form $SnR_{1.5}$. Qualitatively, titanium behaves like tin, but an amperometric titration of titanium is not feasible. Thorium reacts directly to form the diarsonate. The amperometric titrations described permit direct determination of UO_2, Th, Zr and Sn.

KOPELMAN, B. See abs. 409.

KOSHUBA, W. J. See abs. 783.

498. KOSTYLEVA, E. /On the Problem of the Chemical Composition of Zircons./ Compt. rend. acad. sci., U. R. S. S., vol. 23, No. 2, 1939, pp. 167-169.

An analysis is given of zircons in the U. S. S. R.

499. KRAUS, K. A., AND JOHNSON, J. S. Hydrolytic Polymerization of Zirconium

Generated on 2024-09-20 18:04 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

(IV). Jour. Am. Chem. Soc., vol. 75, No. 22, Nov. 20, 1953, p. 5769.

A series of ultracentrifugation experiments carried out indicate that Zr(IV) in acidic solutions does not show continuous polymerization with high-molecular weight products. It does form only low-molecular weight polymers.

500. KRAUS, K. A., AND MOORE, G. E. Separation of Zirconium and Hafnium With Anion Exchange Resins. Jour. Am. Chem. Soc., vol. 71, September 1949, p. 3263.

The experiments that have been carried out have demonstrated that separation of Zr(IV) and Hf(IV) by anion exchange is feasible, although the separation achieved is by no means at its optimum. Experiments are now underway to improve the efficiency of separation.

501. KREIDL, N. J. Zirconium Oxide and Thorium Oxide in Ceramics. Jour. Am. Ceram. Soc., vol. 25, No. 5, 1942, pp. 129-141.

The properties of the most important zirconium compounds are correlated to the main ceramic applications of these compounds, namely, refractories, ceramic bodies, binders, cements, glazes, glasses, and enamels. A brief survey of the information available on the systems MgO-ZrO_2, TiO_2-ZrO_2, SiO_2-Na_2O-ZrO_2, and several other systems is included. The more specific ceramic properties are summarized in short descriptions of the applications to each single field. The ceramic uses of thorium oxide are listed.

502. KRIESSMAN, C. J., AND McGUIRE, T. R. Magnetic Susceptibilities of Hafnium, Gadolinium, and Manganese. Bull. Am. Phys. Soc., vol. 28, No. 1, Jan. 22, 1953, p. 45.

An abstract on work particularly covering the magnetic susceptibility of hafnium.

503. KROLL, W. J., ANDERSON, C. T., HOLMES, H. P., YERKES, L. A., AND GILBERT, H. L. Large-Scale Laboratory Production of Ductile Zirconium. Jour. Electrochem. Soc., vol. 94, No. 1, July 1948, pp. 1-20.

On the basis of results obtained from small-scale laboratory work, equipment for the production of 60 pounds of zirconium sponge a cycle has been placed in operation. Zirconium carbide, prepared from zircon and carbon in an electric arc furnace is chlorinated in improved equipment capable of producing over 300 pounds a day. The raw zirconium chloride is purified in a unit that accommodates nearly 200 pounds. Reduction by magnesium is carried out in the same furnace as the purification. Excess magnesium and magnesium chloride are removed by a combination melting and vacuum distillation method. The zirconium sponge is pressed into briquets and melted in graphite crucibles in a new graphite-resistor vacuum furnace capable of melting over 10 pounds of zirconium a charge.

504. KROLL, W. J., CARMODY, W. R., AND SCHLECHTEN, A. W. High-Temperature Experiments With Zirconium and Zirconium Compounds. Bureau of Mines Rept. of Investigation 4915, 1952, 31 pp.

This report is concerned with the many sidelines that were investigated incidental to developing a process to produce ductile zirconium by members of the staff of the Bureau of Mines laboratory, Albany, Oreg. The results of the main investigation, concerning the production of malleable zirconium by reduction of chloride with fused magnesium under helium, have been described in previous publications. These should be taken as a background to facilitate understanding of this work. Literature on the metallurgy of zirconium has been summarized in a separate publication, and references are given in this report only when new publications have to be considered or old ones stressed. Most of the observations described in this report can be applied to the problems involved in making titanium with virtually

Generated on 2024-09-20 18:07 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

no change. In general, titanium is easier to reduce than zirconium, since its affinities are lower. Also its chloride is easier to handle and keep clean because it is a liquid at room temperature.

505. KROLL, W. J., AND GILBERT, H. L. Melting and Casting Zirconium Metal. Trans. Electrochem. Soc., vol. 96, No. 3, September 1949, pp. 158-169.

This report deals with the methods for melting and casting zirconium. Reference is made to the manner of heating, furnace design, crucible materials, and methods of casting. For the experiments, a high-frequency furnace, an arc furnace, and a split-tube graphite-resistor furnace were used. Preference is given the latter for vacuum fusion, whereas the high-frequency and the arc furnaces are well adopted for melting in a noble gas atmosphere. The crucible materials are discussed, and the melting in graphite and the casting of ingots are described.

506. KROLL, W. J., HERGERT, W. F., AND YERKES, L. A. Improvements in Methods for the Reduction of Zirconium Chloride With Magnesium. Jour. Electrochem. Soc., vol. 97, No. 10, October 1950, pp. 305-310.

It is shown that gaseous zirconium chloride can be piped to a reactor containing magnesium and that the reaction salts can be repeatedly topped to make room for more magnesium, in view of continuing the reduction. This permits using the crucible capacity more fully, with consequent reduction of the production cost. Experiments indicate that part of the magnesium used for the reduction of zirconium chloride can be replaced with sodium. Discusses the advantages and disadvantages of this proposition. Cast iron is a better crucible material than mild steel when used in contact with hot zirconium. A layer of zirconium carbide is formed by zirconium diffusion, which helps reduce iron contamination.

507. KROLL, W. J., AND SCHLECTEN, A. W. Survey of Literature on the Metallurgy of Zirconium. Bureau of Mines Inf. Circ. 7341, 1946, 50 pp.

This report on the bibliography of zirconium has been confined to those publications and patents that appear to be useful in the commercial development of the metal, both the malleable and the nonmalleable. The methods of production have been stressed and special attention has been given to the alloys. Compounds of importance, like the oxide and chloride, for the manufacture of the metal or of the glass and porcelain industries has been omitted. The exhaustive work of Marden and Rich, Bureau of Mines Bull. 186, 1921, has been taken as a base to start from, with the intention of bringing the subject up to date with material published in the last 24 years.

508. KROLL, W. J., SCHLECHTEN, A. W., AND YERKES, L. A. Ductile Zirconium From Zircon Sand. Trans. Electrochem. Soc., vol. 89, 1946, pp. 263-276.

Describes a process for making ductile zirconium metal using zircon sand as a starting material. Solid ingots have been made weighing as much as 365 grams and with a Brinell hardness as low as 197. The ingots can be forged and rolled into sheet. The essential steps of the process are: (1) Production of carbides from zircon sand; (2) chlorination of the carbides; (3) sublimation of the chlorides; (4) reduction of the chlorides with magnesium; (5) vacuum distillation of the reaction products; (6) melting the metal in a vacuum-arc furnace. Describes the apparatus for the various steps, especially the reduction vessel in which zirconium chloride vapor is reduced with magnesium.

KUCHERENKO, O. A. See abs. 47.

KUHN, D. W. See abs. 120.

509. KUHN, D. W., RYON, A. D., AND PALKO, A. A. Vapor Pressures of Zirconium Tetrachloride and Hafnium Tetrachloride. Carbide and Carbon

Generated on 2024-09-20 18:11 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Chem. Corp., November 1949, 21 pp. AECD-2768.

Two methods were used to measure the vapor pressures of zirconium tetrachloride and hafnium tetrachloride over the range from 10 to 10,000 mm. Hg. The lower pressures (10-1,000 mm.) were measured in a nickel diaphragm apparatus that has been used successfully on other compounds by this laboratory and others recently. The higher pressures were obtained using a modification of the capillary 'bridge' apparatus, which was used by the Federal Bureau of Mines in the extensive investigation of the vapor pressures of common metal chlorides.

510. KUHN, W. E. Development of Graphite Electrodes and Study of Heat Losses With Different Electrodes in the Single Electrode Inert-Atmosphere Arc Furnace. Jour. Electrochem. Soc., vol. 99, No. 3, March 1952, pp. 97-108.

A titanium-TiC coated graphite-tipped electrode was developed for melting titanium without excessive carbon pickup. The principles evolved from the melting of titanium and zirconium may be extended to the development of graphite tips coated with other carbide-forming elements. The effect of varying arc length, arc current, and arc voltage on the steady-state heat losses in the cooling water supplied to the electrode, crucible walls, and crucible bottom were studied. Electrode and bottom heat losses increased linearly with increasing current and amounted to about 10 and 4 percent, respectively. Heat extracted by the crucible walls amounted to about 80 percent of the total power input. Short arc lengths and high arc currents tended to improve the melting efficiency. Tungsten-tipped electrodes exhibited more efficient arc melting characteristics than graphite tips.

511. _____. Titanium and Zirconium Castings Now Practicable. Materials and Methods, vol. 12, No. 52, December 1952, pp. 94-95.

In recent years extensive advances have been made in the production of titanium and zirconium, notably in producing sponge, converting sponge into ingots, and reducing ingots into useful engineering shapes by forging, rolling, machining, or combinations of these operations. However, the production of castings has been difficult because of the reactivity of these metals with gases and mold materials. Now a process for melting and casting titanium, zirconium, and their alloys has been developed that has potentialities as a manufacturing procedure for castings ranging from several grams to several pounds. Future development will undoubtedly bring about additional applications for the process for the casting of refractory metals, intermetallic compounds, carbides, etc., into shapes.

KULIN, P. A. See abs. 682.

KULIN, S. A. See abs. 847.

512. KUMINS, C. A. Zirconium Determination in Presence of Interfering Elements. Anal. Chem., vol. 19, 1947, pp. 376-377.

A specific precipitant for zirconium has been discovered that will separate it quantitatively from titanium, iron, vanadium, aluminum, chromium, thorium, cerium, tin, barium, calcium, copper, bismuth, antimony, and cadmium. The method entails the precipitation of the zirconium with mandelic acid from a hydrochloric acid solution as a zirconium mandelate.

513. KURA, J. G. Titanium Casting Research-Tests Shell Molded Refractories. Iron Age, vol. 170, No. 18, Oct. 30, 1952, pp. 88-92.

Titanium's consuming appetite for ordinary refractories has forced the industry to investigate new mold materials for titanium castings. Under Ordnance sponsorship, Battelle has tested many compounds. The most promising are shell-molded mixtures of stabilized zirconia

Generated on 2024-09-20 18:08 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

and fused zirconia containing 4 percent resin and without mold washes. So far best mold wash appears to be a colloidal graphite dispersion. Good surface and soundness of cast titanium containing only small amounts of surface contamination have been obtained.

KURBATOV, J. D. See abs. 514.

514. KURBATOV, M. H., AND KURBATOV, J. D. Determinations of Stable Species $_{39}Y^{89}$, $_{40}Zr^{90}$, and $_{56}Ba^{134}$ Produced by Nuclear Transmutations. Phys. Rev., vol. 71, 1948, p. 466.

An experimental procedure has been developed for determining stable atoms formed by the nuclear transmutations $_{38}Sr^{88}(d,n)_{39}Y^{89}$, $_{39}Y^{89}(d,n)_{40}Zr^{90}$, and $_{55}Cs^{133}(d,n)_{56}Ba^{134}$, when the products are in quantities below 10^{-6} gram. The aim of the work was to evaluate the yield of the competitive reactions d, n producing stable species and d, p, or d, 2n producing radioactive species for a given target. This is an abstract of work performed at Ohio State University, Columbus, Ohio.

515. LAMBERTSON, W. A., AND GUNZEL, F. H., JR. Refractory Oxide Melting Points. Argonne Nat. Lab., Oct. 22, 1952, 3 pp. AECD-3465.

The melting points of some of the refractory oxides were found to be as follows: Al_2O_3 - 2034 ± 16° C., La_2O_3 - 2210 ± 20° C., Nd_2O_3 - 2272 ± 20° C., ZrO_2 - 2710 ± 15° C., UO_2 - 2878 ± 22° C., and ThO_2 - 3220 ± 50° C.

516. LAMBERTSON, W. A., AND MUELLER, M. H. Study of Equilibrium Phases in the System UO_2 - ZrO_2. Argonne Nat. Lab., January 1951, 14 pp. AECD-3068.

Phase equilibrium studies made on the system UO_2 - ZrO_2 reveal that the system consists primarily of two solid solutions separated by a two-phase region, which decreases in area as the temperature is increased. The UO_2 solid solution is cubic. It extends from 0 to 40 percent ZrO_2, by weight, and its lattice parameter varies from 5.460 to 5.277 kX with increasing percent of ZrO_2. The ZrO_2 solid solution is tetragonal and extends from 50 to 100 percent ZrO_2. Its lattice parameters vary as follows: a_o from 5.23 to 5.07 kx and c_o from 5.27 to 5.16 kx. There is also evidence of a solid solution in monoclinic ZrO_2.

LAMONT, J. L. See abs. 138, 139.

LANE, I. R., JR. See abs. 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277.

517. LANE, I. R., JR., GOLDEN, L. B., AND ACHERMAN, W. L. Corrosion Resistance of Titanium, Zirconium and Stainless Steel in Organic Compounds. Ind. Eng. Chem., vol. 45, No. 5, May 1953, pp. 1067-1070.

Titanium is resistant to attack by all concentrations of air aerated formic but is attacked severely by boiling 50 percent acid. It is only slightly resistant to this solution at 100° C. under oxygen-free conditions. This metal exhibits the phenomenon of 'borderline passivity' in certain concentrations of nitrogen aerated 25 and 50 percent formic acid solutions at 60° and 100° C. Corrosion rates for zirconium are negligible. The 20-29 chromium-nickel type stainless steel, in contrast to titanium, is more resistant to oxygen-free formic acid solutions than to those that are air aerated. The three materials show excellent resistance to all concentrations of acetic acid. Stainless steel is appreciably attacked by boiling acetic anhydride and is severely attacked by boiling chloroacetic acid. Both titanium and zirconium are completely resistant to the latter. Titanium is much more resistant than zirconium to the action of boiling dichloroacetic acid. Neither metal is resistant to boiling trichloroacetic acid. Titanium, zirconium, and

Generated on 2024-09-20 18:06 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

stainless steel are fully resistant to all concentrations of air-aerated lactic, tannic, tartaric, and citric acids. Stainless steel shows appreciable corrosion in all concentrations of boiling lactic acid, whereas the other two metals are fully resistant. Corrosion rates for titanium and stainless steel in boiling 50 percent citric acid are appreciable whereas those for zirconium are negligible. Titanium exhibits poor corrosion resistance to even very dilute solutions of oxalic acid at elevated temperatures. In contrast, zirconium corrodes at very low rates. Stainless steel, although not comparable to zirconium, is far more corrosion resistant than titanium in these solutions. Titanium and zirconium give zero or negligible corrosion rates in air-aerated aniline hydrochloride solutions. Stainless steel is unsatisfactory because of a tendency to form deep pits. The three materials are resistant to boiling chlorinated hydrocarbon-water mixtures. With the exception of stainless steel in carbon tetrachloride, these materials also have little or no catalytic effect on the decomposition of the hydrocarbon under such conditions.

518. LANG, S. M., MAXWELL, L. H., AND BURDICK, M. D. Porcelains Within the Beryllia Field of the System Beryllia-Alumina-Zirconia. Nat. Bureau of Standards Research Jour., vol. 45, July-December 1950, pp. 366-373.

The general physical properties of virtually impervious porcelains within the beryllia (BeO) field of the system beryllia-alumina-zirconia (BeO-Al_2O_3-ZrO_2), whose base compositions approximate that of NBS Body No. 4811C, were found to be: Maturing range, 1,500° to 1,600° C.; apparent density, 2.9 to 3.4 gm./cm.^{3}; shrinkage, 17.8 to 20.5 percent; room temperature compressive strength, 238,000 to 305,000 lb./in.^{2}; room-temperature transverse strength, 17,200 to 34,100 lb./in.^{2}; transverse strength after thermal shocking, 17,800 to 31,900 lb./in.^{2}; transverse strength at 1,800° F. (982° C.), 15,000 to 25,100 lb./in.^{2}; approximate Young's modolus at 1,800° F., 28,000,000 to 38,000,000 lb./in.^{2}; relative admixture of 2 weight-percent of calcia (CaO) to the base compositions of these porcelains (without which the specimens would not mature to an impervious structure) caused the appearance of unidentified isotropic phases.

519. LANG, S. M., MAXWELL, L. H., AND GELLER, R. F. Some Physical Properties of Porcelains in the Systems Magnesia-Beryllia-Zirconia and Magnesia-Beryllia-Thoria and Their Phase Relations. Nat. Bureau of Standards Research Jour., vol. 43, November 1949, pp. 429-447.

The ternary eutectic for the system MgO-BeO-ZrO_2 was located at mole composition $4MgO:5BeO:3ZrO_2$ and 1,669° C., and that for the system MgO-BeO-ThO_2 was located at mole composition $5MgO:10BeO:1ThO_2$ and 1,797° C. No binary or ternary compounds were found in either of the systems and on area of solid solution is indicated for each. A number of bodies were found suitable for various high-strength and high-temperature services where thermal shock resistance is not of prime importance. The compressive strength values at room temperature ranged as high as 266,000 lb./in. for some porcelains in both system. The maximum values for the strength in bending at room temperatures and at 1,800° F. (982° C.) were considerably higher for the MgO-BeO-ZrO_2 bodies (39,000 and 32,000 lb./in., respectively) and the modulus of rupture value at 1,800° F. (982° C.) of one body in the binary system MgO-ZrO_2 was 29,000 lb./in. The resistance to thermal shock for the MgO-BeO-ZrO_2 porcelains was fair to good and for the MgO-BeO-ThO_2 porcelains it was poor. All of the MgO-BeO-ZrO_2 bodies can be matured in commercial kilns used currently in the porcelain industry, whereas part of the MgO-BeO-ThO_2 porcelains and none of the MgO-ZrO_2 porcelains can be so matured.

LARSEN, E. I. See abs. 397.

Generated on 2024-09-20 18:54 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

520. LARSEN, E. I., SWAZY, E. F., BUSCH, L. S., AND FREYER, R. H. Properties of Binary Sintered and Rolled Titanium Alloys. Metal Progress, vol. 55, No. 3, March 1949, pp. 359-361.

This paper summarizes development work in the metallurgical research department of P. R. Mallory & Co., under contract with the Navy Bureau of Aeronautics. The purpose of this work was to determine whether titanium alloys exhibited physical and mechanical properties superior to known metals and alloys. The project has been entirely exploratory and, in general has been confined to alloys containing more than 90-percent titanium.

521. LARSEN, E. M., FERNELIUS, W. C., AND QUILL, L. L. Concentration of Hafnium Preparation of Hafnium-Free Zirconia. Ind. Eng. Chem., anal. ed., vol. 15, No. 8, 1943, pp. 512-514.

A satisfactory extraction of the cyrtolite ore is obtained when two parts of concentrated sulfuric acid and one part of 200-mesh ore are heated to a maximum temperature of 210° to 220° C., and the resulting acid-soluble constituents are extracted with water. When acid solutions of dilute zirconyl-hafnyl sulfate and dilute phosphoric acid are simultaneously sprayed into a 10 percent sulfuric acid solution at 70° to 75° C. a dense, compact, and easily filterable precipitate is obtained. By the action of an ice-cold sodium hydroxide-sodium peroxide solution upon a cold slurry of the phosphates and subsequent digestion at 70° C. an acid-soluble hydrate results. This step replaces the usual basic fusion or complex-ion formation as the intermediate step between fractionations. The conditions for the fractional separation of zirconium and hafnium by direct precipitation of the phosphates in dilute solutions were studied. By precipitating approximately 55 percent of the dissolved zirconium-hafnium oxide content of a sulfate solution, the percentage of hafnium oxide of a sample of the mixed oxides is raised from 13 to 93 percent in 7 fractionations and from 59 to 97 percent in 4 fractionations. By treating the mother liquors from the precipitations in similar fashion, a sample of zirconium oxide whose spectrogram revealed no lines characteristic of hafnium is obtained.

522. LARSEN, E. M., AND GAMMILL, A. M. Electrometric Titrations of Zirconium and Hafnium Solutions. University of Wisconsin, January 1950, 13 pp. NP-1398.

Previous quantitative investigations of the changes in ρH during the addition of bases to solutions of zirconium salts appear to be limited to single studies of zirconium in chloride and sulfate solutions. Since the concentration effects on the ρH of precipitation have not been reported for zirconium solutions and since no data are available for hafnium solutions, an investigation of the solutions of these elements with the more common anions in order to establish differences in the behavior of these two elements was undertaken. This report discusses the results of this investigation.

523. LARSEN, E. M., HOWATSON, J., GAMMILL, A. M., AND WITTENBERG, L. Addition Compounds of Zirconium and Hafnium Tetrachlorides With Phosphorus Oxyhalogen Compounds. Jour. Am. Chem. Soc., vol. 74, No. 14, July 20, 1952, pp. 3489-3492.

Zirconium and hafnium tetrachlorides react with $POCl_3$ and $POFCl_2$ to give addition products of the composition $2\ POX_3 \cdot MCl_4$, which decompose under reduced pressure at 50° to 60° to give $POX_3 \cdot MCl_4$. With POF_2Cl and POF_3, the metal tetrahalides give only $POX_3 \cdot MCl_4$ at room temperature. All the 1:1 products when heated decompose with the evolution of the phosphorus oxyhalide, with the temperature at which the decomposition is first observed decreasing with increasing fluorine content of the POX_3. No significant difference is observed in the behavior of the zirconium and hafnium compounds. If the contact time of the MCl_4 with excess $POFCl_2$ or POF_2Cl is long

Generated on 2024-09-20 18:22 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

enough, complete halogen exchange within the phosphoryl molecule occurred and $2POCl_3 \cdot Mcl_4$ was crystallized from solution.

524. LARSEN, E. M., AND SCHULTZ, B. G. Fractional Separation of Zirconium and Hafnium by Extraction With Trifluoroacetylacetone. University of Wisconsin, Jan. 31, 1950, 11 pp. NP-1397.

Zirconium and hafnium were successfully separated by extracting a 0.2N hydrochloric acid solution of the ions with a benzene solution of trifluoroacetylacetone. The zirconium was preferentially extracted into the benzene phase as the chelate compound, tekrakis (1, 1, 1 trifluoro-2,4 pentanediono) zirconium in a manner similar to that observed in the extraction of a zirconium, hafnium perchlorate solution, with thenoyltrifluoroacetone. In two extractions, the mole percent of hafnium in a zirconium, hafnium mixture was reduced from 1.56 to less than 0.1-0.05 with a 6.9 percent yield of the original zirconium, and, in 6 extractions, the mole percent of hafnium in a zirconium, hafnium mixture was increased from 7.5 to 99.98 mole percent with a 37.6 percent yield of the original hafnium.

525. LARSEN, E. M., AND TERRY, G. Extraction of Zirconium and Hafnium With Various B-Kiketones. Jour. Am. Chem. Soc., vol. 75, No. 7, Apr. 5, 1953, pp. 1560-1562.

Distribution coefficients for the partition of zirconium and hafnium between perchloric acid solution and a β-diketone-containing benzene phase were determined for 2-thenoyltrifluoroacetone (HTTA), 2-furoyltrifluoroacetone (HFTA), 2-pyrryltrifluoroacetone (HPTA), and trifluoroacetylacetone (HCTA). The ratios of D_{zr}/D_{hf} at constant hydrogen ion and constant diketone activity were: HTTA, 23; HFTA, 24: HCTA, 13; HPTA, 12.

526. LARSEN, J., AND PETERS, W. C. Idaho. Ind. Eng. Chem., vol. 45, No. 11, November 1953, pp. 2424-2431.

Raw materials are abundant and diverse and constitute major portions of the nation's reserves of many strategic materials. Idaho's mountainous terrain has permitted development of only the richest and most accessible reserves. The Coeur d'Alene region holds large reserves of lead, zinc, and silver; associated products include antimony, cadmium, and sulfur. Southeast Idaho's phosphate beds constitute more than 85 percent of the nation's reserves, and large cobalt and antimony reserves are found in the State. Monazite, zircon, titanium, tungsten, and beryllium deposits are of significance.

527. LATIMER, W. M. Tables of Free Energy Functions for Elements and Compounds in the Temperature Range 2,000° - 5,000° K. Atomic Energy Comm., September 10, 1947, 11 pp. MDDC-1462.

Tables are given summarizing $\frac{\Delta F - \Delta H_o^\circ}{T}$ values for the elements H, B, C, N, O, F, Na, Mg, Al, Si, Cl, Ca, Ti, Zr, and Fe and the compounds H_2, C_2, N_2, O_2, HF, OH, CO, MgH, NO, HCl, CN, SiN, ZrO, SiO, TiO, BO, SiF, NaCl, NH, CH, SiH, AlO, BH, AlH, MgO, and FeO, as gases, over the temperature range 2,000° to 5,000° K. The free energies and equilibrium constants for the dissociation of the compounds are summarized over the same temperature range. The free energy functions and equilibrium constants are also given at 2,000° K. for the solids MgO, CaO, TiO, and SiO_2 and for CO_2 gas at 2,000° and 3,000° K.

528. LATING, J. Gas Phase Reactions of Zirconium...A Review of the Literature. Atomic Energy Research Est., AERE M/TN 7, England, April 1951, 13 pp.

Published information on the gas phase reactions of zirconium is reviewed. The following general conclusions can be drawn: (1) Hydrogen reacts with zirconium in much the same way as it does with palladium. (2) With most other gases little significant attack occurs below

Generated on 2024-09-20 18:08 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

400° C. Above this temperature it reacts with oxygen, nitrogen, carbon monoxide, carbon dioxide, water vapour, propane, ammonia, and sulfur dioxide, the rate increasing rapidly with increase of temperature. (3) It seems probable that only the inert gases are stable towards zirconium at high temperatures. (4) The reaction products (for example, ZrO_2 and ZrN) are soluble in the metal and greatly influence its physical properties. (5) No significant improvement is obtained by alloying.

529. LAUBENGAYER, A. W., AND EATON, R. B. Reducibility of Quadrivalent Zirconium. Jour. Am. Chem. Soc., vol. 62, October 1940, pp. 2704-2706.

Investigations of the reducibility of quadrivalent zirconium in aqueous solution by electrolysis and by the polarographic method indicate that quadrivalent zirconium cannot be reduced to a state of intermediate valence by electrolysis of solutions of zirconium salts. Nonstepwise reduction to the metal appears to take place at potential of about 1.69v. (Polarographic deposition potential against 1 N calomel.) Metal deposition potential varies with the pH of the solution, probably owing to the variation of the nature of the complex ions formed by zirconium.

LAURIE, D. See abs. 145.

LEE, H. T. See abs. 77.

530. LEE, I. O. Mineralogy of Hafnium. Am. Chem. Soc., vol. 5, December 1926, pp. 17-37.

This paper reviews the discovery of the association of hafnium with zirconium. All the minerals in which hafnium is found have been analyzed and discussed. Foreign and domestic deposits of hafnium are discussed and analyses given.

531. LEONTIS, T. E. Effect of Zirconium on Magnesium-Thorium and Magsium-Thorium-Cerium Alloys. Jour. Metals, vol. 4, No. 6, June 1952, pp. 633-642.

Data are presented in this paper to show that addition of zirconium to sand-cast Mg-Th alloys effects a marked decrease in the grain size of these alloys, which is accompanied by a significant increase in the mechanical properties over the entire range of thorium content investigated. The beneficial effect of zirconium on the strength properties is maintained at elevated temperatures up to 700° F. In addition the alloys exhibit exceptionally high creep resistance at temperatures up to 600° F. Zirconium does not greatly improve the strength or creep characteristics of extruded Mg-Th alloys. Cerium is not a desirable addition to Mg-Th-Zr alloys.

532. LEVAN, A. Cytological Reactions Induced by Inorganic Salt Solutions. Nature, vol. 156, No. 3973, Dec. 22, 1945, pp. 751-752.

An investigation has been carried on for some time into the immediate cytological effect of salt solutions on root meristems of Allium Cepa. Salts, mostly nitrates, of some 40 metals were tested. A dilution series of 10-16 concentrations were studied for each substance, covering the whole range from total lethality down to such weak concentrations that no cytological effect could be detected. Fixations of root tips were made after 4 and 24 hours, respectively. All slides were stained with crystal-violet.

LEVI, H. See abs. 404.

LEVIN, J. S. See abs. 423.

533. LEWIS, M. Determination of Radioactive Zirconium. Anal. Chem., vol. 23, No. 4, April 1951, p. 681.

A precise method with a minimum amount of sample manipulation was developed for determining radiozirconium in uranium-containing solutions. This is an abstract on work performed by General Electric Co.

LIBMAN, E. E. See abs. 933.

Generated on 2024-09-20 18:03 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

534. LIDMAN, W. G., AND HAMJIAN, H. J. Reactions During Sintering of a Zirconium Carbide-Niobium Cermet. Jour. Am. Ceram. Soc., vol. 35, No. 9, September 1952, pp. 236-240.

A zirconium carbide-niobium cermet (12.5 percent by weight of columbium (niobium)) sintered under pressure was investigated. The effect of the variables, sintering temperature, and time at temperature, on the crystallographic structures was examined by back-reflection X-ray diffraction. Lattice-parameter determinations indicated that the following reaction occurred:

$$Cb + ZrC \xrightarrow{\text{heat}} CbC + Zr$$

$$ZrC + NbC \xrightarrow{\text{heat}} ZrC.CbC \text{ (solid solution)}$$

Metallographic examination showed that at 3,900° F. zirconium metal formed in the grain corners of the carbide structure. Coalescence of this phase was observed; the size and distribution of the phase influenced the room-temperature strength of this material and were time and temperature dependent.

LIEBHAFSKY, H. A. See abs. 966.

535. LIEBHAFSKY, H. A., AND WINSLOW, E. H. Hydroxyanthraquiones as Analytical Reagents. Colorimetric Determination of Zirconium or Hafnium. Jour. Am. Chem. Soc., vol. 60, August 1938, pp. 1776-1784.

With the aid of a photoelectric recording spectrophotometer, precise colormetric methods for the determination of zirconium or hafnium in small amounts have been developed. The methods involve lake formation with the hydroxyanthraquinone dyes.

536. _____. Spectrophotometric Study of the Hafnium-Alizarin Lake. Jour. Am. Chem. Soc., vol. 69, May 1947, pp. 1130-1134.

Spectrophotometric evidence has been obtained to show that the hafnium-alizarin lake is a definite chemical compound, the two constituents being combined in equimolal amounts. There appears to be little or no adsorption of excess dye. Under some conditions lake formation is incomplete. On the basis of the evidence available, the hafnium lake has been assigned a chelate-ring formula different from the inner complex type of chelate ring usually assumed for the lakes (such as that of ferric ion) unstable toward acid.

537. LIEBHAFSKY, H. A., AND ZEMANY, P. D. Polychromatic X-ray Beams. Anal. Chem., vol. 23, No. 7, July 1951, pp. 970-972.

For monochromatic X-ray beams, the mass absorption coefficient of a mixture (or solution) stands in additive relationship to the coefficients of the elements free or combined, contained therein. The existence of this relationship facilitates the use of X-ray absorption methods in analytical chemistry. Ordinarily the additivity exists also for polychromatic beams, but marked deviations therefrom occur in the zirconium-hafnium system. The present investigation proves that such deviations are traceable to absorption edges. For selected pairs of elements, the occurrence of an absorption edge can cause an inversion in the relationship of their absorption coefficients for monochromatic beams - that is, the element having the greater coefficient at wave lengths below that of the edge may have the smaller coefficient at wave lengths above it. If the inversion occurs within the wave-length range of a polychromatic beam, the deviations in question may result. In the two systems studied, these deviations take the form of absorbence maxima as composition is varied, but other forms are possible. Although the occurrence of these deviations restricts the usefulness of polychromatic beams in chemical analysis, it will often be possible to carry out the analysis by X-ray methods under other experimental conditions.

538. LIGHT METAL AGE. Mechanical Properties of Zirconium. Vol. 11, No. 11,

Generated on 2024-09-20 18:03 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

12, December 1953, pp. 16-18.

Principal uses of zirconium will be more and more in the chemical industries where corrosion resistance is essential. This report covers the mechanical properties of zirconium from the standpoint of its use in the chemical industries.

539. LILLIENDAHL, W. C., GREGORY, E. D., AND WROUGHTON, D. M. Removal of Embrittling Gases From Zirconium. Jour. Electrochem. Soc., vol. 99, No. 5, May 1952, pp. 187-190; Westinghouse Atomic Power Div., April 9, 1951, 8 pp. AECU-1226; NYO-1014.

Describes a process for removing dissolved oxygen from zirconium by heating the solid metal in molten or gaseous calcium. The equilibrium oxygen-zirconium ratios have been determined as a function of the time and temperature of treating. Nitrogen is not removed in the treating cycle and contamination of the treated metal with this impurity may occur. This may be prevented by a careful control of treating temperatures. At high treating temperatures the process may be used to remove nitrogen from calcium.

540. LILLIENDAHL, W. C., AND RENTSCHLER, H C. Recent Developments on the Preparation of Zirconium. Trans. Electrochem. Soc., vol. 91, 1947, pp. 285-297.

Presents a general survey of contemporary work on the preparation of zirconium. Experimental equipment for producing rare metals in general is described and applied to zirconium by a detailed study of the reaction: $ZrO_2 + 2Ca = Zr + 2CaO$. The relation of excess reducing agent and addition agents to residual impurities in the metal product is evaluated, and the effect of these impurities on sintered and melted compacts is shown. By the control of variables referred to above, the preparation of relatively soft easily machinable zirconium compacts is described and some physical properties of the metal are determined and recorded.

541. LILLIENDAHL, W. C., AND WROUGHTON, D. Preparation of Zirconium by Fused Salt Electrolysis. Westinghouse Elec., Sept. 15, 1949, 10 pp. NYOO-1010.

The possibility of obtaining zirconium metal by electrolytic deposition from a fused salt electrolyte was investigated. The primary objective of the work was to establish the essential feasibility of producing coherent zirconium directly by such a process, but the project was curtailed abruptly and only preliminary investigations were completed. Specific electrolytes investigated comprised two component eutectic mixtures of NaCl, KCl, CaCl, and KF to which $ZrCl_4$ was added. The results indicate that a satisfactory electrolysis is possible with the three eutectics KCl-NaCl, $CaCl_2$-KCl, and KF-KCl, the product being zirconium powder in all cases with the particular conditions of operation. They further show that zirconium chloride forms a stable solution in fused salt baths containing a potassium salt at a temperature of about 750° C. The yields of zirconium powder and current efficiencies for the eutectic baths KCl-NaCl and $CaCl_2$-KCl were estimated, and the approximate metal content of the deposited powder was determined. Microscopic investigation of the powder obtained suggests the possibility of plating from some compositions, particularly the KF-KCl eutectic.

542. LILLIENDAHL, W. C., WROUGHTON, D. M., AND GREGORY, E. D. Quantitative Evaluation of Oxygen in Zirconium. Trans. Electrochem. Soc., vol. 93, No. 6, June 1948, pp. 235-247.

Of the methods described for the evaluation of oxygen in zirconium, it may be generally stated that the indirect method is of value as a control method or where the oxygen content is relatively high and the necessary correction factors are known with certainty. The direct method shows a precision of approximately 0.02 percent oxygen using 2 gm. samples for analysis. The accuracy cannot be evaluated with certainty

Generated on 2024-09-20 18:03 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

from the limited work done, but, in general, it appears that the results are a little low. The effect of nitrogen on the analytical determination of oxygen is being studied but data are not available. This is important in the analysis of commercial zirconium but has little influence on results reported here, especially on Foote Mineral wires since the nitrogen content is approximately 0.01 percent. The hardness of zirconium depends somewhat upon the microstructure of the metal even in well annealed pieces. There is a rapid increase in hardness with increasing oxygen content, and it is probable that zirconium containing 0.2 percent dissolved oxygen or more would be cold workable only with difficulty. It is known that nitrogen too increases the hardness of zirconium, although to what extent has not yet been determined.

LILLY, R. C. See abs. 420, 421, 422.

LIN, C. C. See abs. 895.

LINFORD, H. B. See abs. 71.

543. LISTER, B. A., AND McDONALD, L. A. Cation Exchange Separation of Zirconium and Hafnium. Atomic Energy Research Est., AERE C/R 703, England, April 1951, 39 pp.

The separation of zirconium and hafnium by cation exchange methods has been examined and a method developed depending on sulfuric acid elution whereby a complete separation of gram quantities of the elements in their natural proportions can be made in one experiment. The method is claimed as the simplest and most satisfactory now available for this purpose on a laboratory scale.

544. _____. Some Aspects of the Solution Chemistry of Zirconium. Jour. Am. Chem. Soc., vol. 74, November 1952, pp. 4315-4330.

Some experiments are described dealing with the chemistry of zirconium in nitric, hydrochloric, perchloric, and sulfuric acid solutions. Ion-exchange techniques have been used to determine the ionic charge of zirconium species and the degree of cation-anion interaction to form complex cations and to illustrate the presence of anionic complexes in solution. In addition, the rate of diffusion from solution into exchangers of different degrees of crosslinking has given information on ionic size at various acidities. Other experiments include the measurement of the rate of self-diffusion in solution, electromigration studies, and pH determinations. The results are interpreted as indicating the presence at lower acid concentrations of polynuclear hydrolysis products and at higher acidities of such complexes as (in nitric acid solution) $(Zr(NO_3)_2(H_2O)_4)^{2+}$, $(Zr(OH)_2(NO_3)(H_2O)_3)^{+}$ and $(Zr(OH)_2(NO_3)_4)^{2-}$. Great differences are apparent between the behavior of ionic species of zirconium and thorium in comparable solutions.

545. LISTER, M. W., AND SUTTON, L. E. Investigation by Electron Diffraction of the Structures of Some Tetrahalides. Trans. Faraday Soc., vol. 37, March 1941, pp. 393-406.

The structures of a number of tetrahalides have been determined from the scattering of fast electrons by their vapors. In every case where the configuration would have an important effect upon the mode of scattering it was found that the assumption of a tetrahedral molecule was entirely satisfactory. A different configuration might be expected for selenium tetrachloride, but the photographs obtained did not allow of a decision being made.

546. LITTON, F. B. High Purity Zirconium Metal. Metal Progress vol. 60, No. 6, December 1951, pp. 83-86.

An investigation was conducted by the Research and Development Department of the Foote Mineral Co. for the United States Air Force whose primary object was to prepare zirconium low in hafnium for use in determining the physical

Generated on 2024-09-20 18:06 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

properties of essentially pure metal.

547. LITTON, F. B. Ten Zirconium Alloys Evaluated. Iron Age, Part I, vol. 167, No. 14, Apr. 5, 1951, pp. 95-99; Part II, vol. 167, No. 15, Apr. 12, 1951, pp. 112-114.

Part I: The mechanical and oxidation resistance properties of 10 zirconium alloys cover 10 alloying elements including oxygen and nitrogen. Hafnium up 8.2 percent did not affect tensile properties. Aluminum increased strength as did titanium, tantalum, columbium, oxygen, and nitrogen. In general, zirconium alloys are not as resistant to oxidation as the commercially pure metal. Part II: The oxidation resistance of zirconium is not improved by alloying. Minor amounts of aluminum and nitrogen decreased, while oxygen slightly increased, oxidation resistance, Arc-melted metal had better resistance to oxidation than did induction or graphite crucible melted zirconium.

548. _____. Zirconium Alloy Project, Report No. 6. Foote Mineral Co., Dec. 29, 1948, 9 pp. NP-1096.

The hot workability of zirconium-aluminum and zirconium-tantalum-aluminum alloys were further investigated at 900° C. Additional zirconium-tantalum alloys were prepared for test purposes. Zirconium-columbium and zirconium-tantalum-columbium alloys were prepared. Preliminary tensile properties of zirconium-titanium and zirconium-titanium-aluminum showed that these alloys possessed high strength which could be improved by heat-treatment. Work was continued on the preparation of 0.10 Hf containing zirconia and the preparation of relatively pure hafnia. Concentrating unit for the latter has been installed that is capable of handling 500 gallons of starting solution. Chlorination runs on zirconium oxide ore are reported. Sublimation apparatus was set-up and about 20 lbs. $ZrCl_4$ containing 0.8 percent Hf were sublimed under hydrogen preliminary to producing iodide metal.

549. LITTON, F. B., AND OGBURN, S. C., JR. Research on Zirconium Alloys. Foote Mineral Co., Dec. 12, 1949, 32 pp. AF-TR-5943 C.1.

Further determination has been made of the physical and mechanical properties of iodide zirconium. Induction melting of zirconium and zirconium alloys in vacuum using graphite crucibles and arc melting under a purified argon atmosphere in a water-cooled copper crucible are compared. Iodide zirconium was found not suitable for use in air at 750° C. owing to poor oxidation resistance, although it might be considered for use at 400° C. Most of the binary and ternary alloys developed were found greatly inferior to iodide zirconium in oxidation resistance. Zirconium and zirconium alloys containing from 0.1 to 8.2 percent hafnium have been prepared. Initial results indicated that hafnium had no pronounced effect on the strength properties of zirconium. Preliminary corrosion tests have been made on both zirconium and zirconium alloys.

LOEWENSTEIN, W. See abs. 230.

LOFGREN, N. L. See abs. 187.

550. LOGAN, H. L., AND HESSING, H. Stress Corrosion of Wrought Magnesium Base Alloys. Nat. Bureau of Standards Research Jour., vol. 44, March 1950, pp. 233-243.

The rates of corrosion of many metals and alloys are increased by the presence of tensile stresses in the materials. To determine the effect of tensile stress on the behavior of magnesium alloys exposed to corrosive medium, stress-corrosion tests were made on several magnesium base alloys at two weather exposure sites, in the laboratory by continuous immersion in a NaCl + K_2CrO_4 solutions and by intermittent immersion in a dilute NaCl solution. The periods of time to failure of specimens exposed under tensile stress in the atmosphere at the National Bureau of Standards were less than those for the same materials exposed in a marine atmosphere at Hampton

Generated on 2024-09-20 18:10 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Roads, Va. The M1 clad AZ31X-h sheet alloy proved more resistant to stress corrosion than bare AZ31X-h, AZ51X, or AZ61X sheet alloys and AZ80X extruded alloys. Predictions of relative susceptibility of materials to stress corrosion from intermittent immersion laboratory tests in a 0.01-percent NaCl solution were in good agreement with the results obtained from weather exposure tests at this Bureau.

551. LOMAS, J. Hafnium. Canadian Min. Jour., vol. 74, No. 11, November 1953, pp. 80-81.

A general survey of hafnium covering history, properties, and uses.

LONES, J. See abs. 722.

552. LONG, J. R. Use of Ammonium Bifluoride in the Preparation of Fluorides From Oxides. Ames Lab., Iowa State College, Aug. 21, 1948, 40 pp. AECD-3203.

This is a treatise on the use of ammonium bifluoride in the preparation of anhydrous fluorides from oxides, dealing primarily with those compounds of thorium, but also with those of zirconium, lead, and zinc.

LOOMIS, F. See abs. 800.

LUBKER, R. A. See abs. 52.

553. LUNDELL, G. E., AND KNOWLES, H. B. Determination of Zirconium and Titanium in Zirconium Ores. Jour. Am. Chem. Soc., vol. 42, May 10, 1920, pp. 1439-1448.

Gives the various elements to be found in ores (including zirconium); decomposition of the ore; Bureau of Standards method for determination of zirconium and titanium in zirconium ores; procedures; analyses, and results.

554. LUNDIN, C. E., McPHERSON, D. J., AND HANSEN, M. System Zirconium-Copper. Jour. Metals, vol. 5, No. 2, sec. 2, February 1953, pp. 273-278.

The zirconium-copper phase diagram has been studied and found to be characterized by 12 features involving solubilities, eutectics, intermetallic compounds, and intermedia phases, all of which are discussed and summarized.

LUPTON, H. See abs. 644.

LUSBY, W. E., JR. See abs. 243.

LUSTMAN, B. See abs. 583, 584.

555. LUTTRELL, C. B. Glazes for Zircon Porcelains. Jour. Am. Ceram. Soc., vol. 32, No. 10, Oct. 1, 1949, pp. 327-332.

An investigation was conducted to develop a white opaque low-expansion glaze of suitable glass and texture for commercial application on zircon porcelain. A glaze containing the alkaline-earth zirconium silicates was selected as the base glaze; batch changes and molecular adjustments were then made. On a molecular basis the KNaO content should be low (less than 0.20 equivalent); the alkaline-earth oxides should be used to raise the RO group to 1.00. High MgO (from 0.40 to 0.50 equivalent) definitely reduces crazing tendencies; CaO and ZnO complete the RO group. The most desirable Al_2O_3 and SiO_2 ratio considerably affects the finish and improves crazing resistance; B_2O_3, although important as a low-expansion constituent, is limited to 0.2 equivalent. The compositions of glazes applicable to typical zircon porcelain bodies are given.

556. MacDONALD, E., AND BAHNER, C. T. Hafnium Complexes for Biological Investigation. Proc. Soc. Exper. Biol. and Med., vol. 83, No. 4, 1953, pp. 801-804.

The distribution of Hf^{181} in rats was different when different hafnium complexes were administered. The median liver: Femur concentration ratios with various complexing agents were in order mandelate > catechol disulfonate > citrate > gluconate. Differences were observed in other organs also.

Generated on 2024-09-20 18:10 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

MACE, W. See abs. 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295.

557. MacMULLIN, R. B. By-products of Amalgam-Type Chlorine Cell. Chem. Eng. Prog., vol. 46, No. 9, September 1950, pp. 440-455.

Utilization of metal amalgams in the preparation of industrially important chemicals and in the separation and purification of metals is a comparatively new science. In this paper the technical basis for the formation and utilization of amalgams is discussed. Describes processes for the production of free metals such as sodium, potassium, lithium, zinc, and lead by two different techniques - 1. distillation of mercury from the amalgam, and 2. electrodeposition of alkali amalgams with water, and metal alcoholates by decomposition of the amalgam with a suitable anhydrous alcohol. Various metallic salts are produced by direct union of the metal dissolved in the amalgam with other elements and acidic compounds to produce, for example, sodium sulfide, sodium hydrosulfite, sodium chlorite, and sodium nitrite. Amalgams are useful for organic reductions and toluene. The latter compound can be further used in a cyclic process for the production of hydrogen peroxide. Additional applications in the field of amalgam metallurgy include phase-exchange reactions and reduction of metallic chlorides with sodium amalgam to produce such metals as titanium and zirconium.

MADDEN, H. T. See abs. 81.

558. MAGEL, T. T. Vacuum Reduction of Some Metallic Oxides Using Zirconium. Massachusetts Inst. Technol., January 1952, 13 pp. AECD-3321; MIT-1081.

Several of the more electropositive metals have been prepared by high-temperature vacuum reduction of their oxides with zirconium. The method is especially suitable for milligram- or gram-scale preparations and has been used to prepare 77 mg. of radioactive Be^7 from Be^7O. Attention is again called to the possible hazardous nature of the zirconium reduction of compounds other than oxides, especially sulfates of the alkali metals.

559. MAGEL, T. T., KULIN, P. A., AND KAUFMANN, A. R. Inductive Melting of Reactive Metals Without Refractory Containers. Massachusetts Inst. Technol., January 1952, 12 pp. AECD-3320.

Reactive metals having a high melting point, such as titanium and zirconium, are not easily melted satisfactorily. Oxide crucibles are more or less worthless for such materials, whereas graphite crucibles usually lead to an undesirable carbon pickup. Arc melting in a water-cooled, copper crucible has been extensively developed and used but is not entirely satisfactory, particularly for making homogeneous alloys. Two methods of induction melting without refractory crucibles have been under development and in laboratory use at the M.I.T. Metallurgical Project for several years.

560. MAJUMDAR, B. L. Ceramic Materials for the Construction of Engineering Parts. Ceramics, vol. 5, No. 55, September 1953, pp. 314-320.

This article is concerned principally with special ceramic materials with unusual mechanical and thermal properties. Failures of engineering metals and alloys have been observed and discussed and an investigation conducted into causes and possible remedial measures.

561. _____. Ceramic Materials in High Temperature Heat Engines: A Review. Trans. Indian Ceram. Soc., vol. 12, No. 2, June 1953, pp. 1-26.

The scope of the potential application of high-temperature ceramic materials in heat engines has been indicated. In addition to turbine blading, other requirements for power plant include

Generated on 2024-09-20 18:10 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

materials for the interior of the turbine engine tubes, for tailcones and tailpipes, for after-burner parts, for rocket combustion chamber liners and nozzles, for missile combustion chambers, guide vanes and reactors, for application to supersonic airfoils and for other vital uses in jets, rockets, and guided missiles. A number of ceramic materials have shown better performance and tensile properties at elevated temperature than the existing alloy steels. Certain carbide materials possess good thermal shock resistance and operate better than most high-temperature alloys or oxide refractories. Their performance is, however, limited by thermal shock resistance (oxides) and by oxidation problems (carbides). Even when the problems of strength, oxidation resistance and resistance to thermal shock have been overcome, the problem of fabrication remains. From the present available data, the use of ceramic-stator blades can be visualized and their application in an aircraft engine will greatly reduce the weight and cost but high inlet gas temperature may perhaps not be permissible. The life of turbine wheels either completely or partly fitted with ceramic blades has been found to be short, primarily because of mechanical design troubles that could not be anticipated. Although results are not adequate from the standpoint of aircraft requirements, they encourage further research. The application of high-temperature ceramic coatings barely has been touched. As a result of the war-time researches, they are already in use for many military purposes. It is expected that continued researches will lead to materials suitable for application in a new and higher temperature range.

562. MALICH, C. W., AND FANEUFF, C. E. Gamma Radiation From Neutron Excitation of Zirconium and Hafnium. Bull. Am. Phys. Soc., vol. 28, No. 5, Sept. 2, 1953, p. 23.

An abstract of a paper on gamma radiation in work done by the Naval Research Laboratory.

MALLETT, M. W. See abs. 885.

563. MALLETT, M. W., BARODY, E. M., NELSON, H. R., AND PAPP, C. A. Diffusion and Solubility of Nitrogen in Beta Zirconium. Jour. Electrochem. Soc., vol. 100, No. 3, March 1953, pp. 103-106.

A study has been made of the diffusion of nitrogen in beta zirconium in the temperature range of 900° to 1,600° C. at 1 atmosphere pressure. Diffusion-rate calculations based on a solution of the usual diffusion equation gave a diffusion coefficient, $D_B = 3 \times 10^{-2} e^{-33,600/RT}$ cm^2/sec. The energy of activation of diffusion, 33,600 cal/mole, has a probable error of 1,600 cal/mole. The limiting solubilities of nitrogen in beta zirconium were determined from the diffusion data.

564. _____. Surface Reaction of Nitrogen With Beta Zirconium and the Diffusion of Nitrogen in the Metal. Battelle Mem. Inst., BMI-709 rev., Dec. 12, 1951, 29 pp.

A study has been made of the nitrogen-zirconium reaction in the temperature range of 900° to 1,600° C. at 1 atmosphere pressure. Examination of the data showed that the reaction follows a parabolic law after an initial deviation. The parabolic rate constant has been calculated in square centimeters per second to be: $k = 8.5 \times 10^5 e^{-67,500/RT}$, in which 67,500 calories per mole is the activation energy, within a probable error of ±1,500 calories per mole. Diffusion-rate calculations based on a special solution of the usual diffusion equation gave a diffusion coefficient, $D_B = 8.06 \times 10^{-2} e^{-36,400/RT}$ cm^2 per second. The energy of activation of diffusion, 36,400 calories per mole, has a probable error of ± 2,100 calories per mole.

565. MANDEVILLE, C. E., SHAPIRO, E., MENDENHALL, R. I., ZUCKER, E. R., AND CONKLIN, G. L. Gamma-Radiations from Zr^{95} and Nb^{95}. Phys. Rev., vol. 89, No. 3, Feb. 1, 1953, pp. 559-560.

Generated on 2024-09-20 18:03 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

By employing lead absorption, coincidence counting techniques, and scintillation spectrometry, it has been shown that each beta-ray of Nb^{95} is followed by a gamma-ray of energy 0.76 ± 0.02 Mev and that most of the beta-rays of the parent element Zr^{95} are followed by a single gamma-ray at 0.73 ± 0.02 Mev. A disintegration scheme is proposed.

MANIWA, H. See abs. 771.

MANNING, G. K. See abs. 591.

MARAGHINI, M. See abs. 913.

566. MARAGHINI, M., ADAMS, G. B., JR., AND van RYSSELBERGHE, P. Anodic Polarization of Zirconium and Zirconium Alloys. University of Oregon, September 1953, 35 pp. The material in this paper was presented under the same title at the Wrightsville Beach meeting of the Electrochem. Soc., September 1953.

The anodic polarization of zirconium and of some of its alloys was studied in several aqueous electrolytes. In chloride solutions, corrosion potentials below that of oxygen evolution were established, but the addition of nitrate ion in the ratio of 3 to 5 to chloride ion brings the potential above that of oxygen evolution. The formation of the oxide film along the three portions of the potential-time curve (initial rapid increase, evolution of oxygen at virtually constant potential, final rapid increase) was studied in detail and quantitative information about local currents and the efficiency of the film building process was obtained.

567. MARDEN, J. W., AND RICH, M. N. Investigations of Zirconium, with Especial Reference to the Metal and Oxide, Historical Review and a Bibliography. Bureau of Mines Bull. 186, 1921, 147 pp.

That there is wide interest in the preparation and properties of metallic zirconium and its salts is indicated by the many articles recently published in scientific and technical journals and the many patents issued. The compounds of zirconium have numerous important uses, and more uses will doubtless be found. In the course of the special work on rare metals that were of military importance during the war, the authors of this bulletin were detailed to the Golden mining experiment station of the Bureau of Mines to prepare metallic zirconium and to investigate its properties.

MARSH, C. A. See abs. 311.

568. MARSHALL, D. W. Electric Furnace Fusion and Purification of Zirconia. Brick and Clay Record, vol. 118, No. 6, June 1951, p. 62.

Fused stabilized zirconia is made by a unique electric arc furnace process in which low-purity zirconia ores are purified and stabilized during a single furnace fusion. This process has a decided advantage over other methods of production in which the purification and stabilization require two or more steps.

569. MARSHALL, D. W., AND WHITTEMORE, O. J., JR. Fused Stabilized Zirconia Refractories. Chem. in Canada, vol. 4, November 1952, pp. 23-28.

The new, low-cost process described in this paper produces refractories that have many unique properties of great value. Uses for this fused stabilized zirconia have included linings for furnaces operating to 2,500° C., setters for firing titanates, containers for steel and platinum and resistors for oxide resistor furnaces. Before the development of this new process by two Canadian researchers of The Norton Co., extensive use of zirconia as a refractory had been limited by its high cost.

MARSHALL, J. See abs. 178.

MARTIN, A. V. See abs. 129.

MARTIN, E. W. See abs. 350.

Generated on 2024-09-20 18:02 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

570. MARTINI, W. R. Compilation of Vapor Pressure Data for the Elements From Br to U and Their Oxides and Carbides. North Am. Aviation, Inc., NAA-SR-215, Mar. 20, 1953, 44 pp.

This report is a compilation of vapor pressure data, taken from available literature, for elements in the periodic table from Br to U and also for the oxides and carbides of these elements. The vapor pressures are plotted as log P vs 1/T on a scale large enough to be conveniently usable. When the vapor pressure at only one temperature was available for a substance, the 'point of convergence' suggested in NAA-SR-132 was used as the second point on which to base the graph. This point of convergence was given as 10,000 atmospheres and 10,000° C. If two sets of data appeared comparably reliable, both were plotted. In addtition to the vapor pressure charts, the following data have been tabulated for the elements, oxides, and carbides: Melting point, boiling point at 760 millimeters of Hg, standard free energy of formation (for the compounds), and the range of temperature over which vapor pressures are known. The tables are cross-referenced to the charts. The free-energy - temperature equations have also been included.

MARTINSON, M. W. See abs. 596.

MASON, W. B. See abs. 236.

MASTELLER, R. D. See abs. 447.

571. MATERIALS AND METHODS. Civilian Zirconium Production Boosted. Vol. 38, No. 6, December 1953, pp. 230, 232, 234.

A line of new vacuum melting furnaces will start pouring zirconium ingots for industrial use early in 1954. Privately financed by the Firth Sterling Corp., the facility will operate as a civilian unit and will not be under control of government contract. The company is putting finishing touches on an installation at Trafford, Pa., which will turn out 360,000 lb. of zirconium ingots per year from Kroll process sponge.

572. _____. Materials Engineering File Facts, Materials Data Sheet, Titanium, Molybdenum, Zirconium, and Hafnium. Vol. 37, No. 6, No. 254, June 1953, pp. 125, 127.

Titanium, molybdenum, zirconium, and hafnium are recent additions to the metals available in ductile form. Titanium and molybdenum are in limited commercial use. Zirconium is used at present chiefly in Atomic Energy Commission applications. Hafnium has no present commercial applications. Tungsten and tantalum are established in their respective fields and are widely used commercially. Columbium is used chiefly as an alloying element in the stainless steels, but has limited commercial applications also. Vanadium, most recent of the group to be obtained in ductile form, is limited at present to Atomic Energy Commission applications.

573. _____. Zirconium Offers Interesting Properties and Possibilities. Vol. 32, No. 4, October 1950, pp. 63-64.

Zirconium with its high stength and excellent corrosion resistance is finding many new uses in addition to those in electronics where it is now used extensively. Uses, properties, and processes are covered.

574. MATHER, R. F. Zirconia-Magnesia Spinel System. Jour. Am. Ceram. Soc., vol. 25, No. 3, 1942, pp. 93-96.

An investigation of the zirconia-spinel system, ZrO_2-$MgAl_2O_4$, was made, using the criteria of thermal expansion, density, and microstructure. The samples were fired for 6 hours at 1,650° C. No stable compounds or solid solutions were formed. An unstable solid solution, possibly based on a zirconia-spinel compound, was formed, however, apparently extending from pure spinel to 30 mole percent of zirconia. The solid solution gradually decomposed on repeated heating to 1,300° C., and the system ultimately behaved as a series of simple aggregates of zirconia

Generated on 2024-09-20 18:06 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

and spinel. The zirconia transformation took place at 1,110° C. throughout the system. On cooling, the transformation temperature was lowered by the presence of spinel from 990° C. for the zirconia-rich samples to 630° C. at the spinel end of the system.

575. MAXWELL, C. R. Hot Wire Reduction of Metals. Los Alamos Sci. Lab., Sept. 10, 1946, 8 pp. MDDC-296.

The hot wire method for the preparation of pure metal consists basically of decomposing a volatile compound of the element in question upon the surface of an incandescent body. The method has the advantage over most other methods in that it yields directly a compact metal without the possibility of contamination from a crucible wall.

MAXWELL, L. H. See abs. 518, 519.

576. MAYER, A., AND BRADSHAW, G. Absorptiometric Determination of Zirconium by Means of Alizarin-S With Special Reference to Magnesium Alloys. Analyst, vol. 77, September 1952, pp. 476-483.

It is shown that the colored reaction product of zirconyl ions and alizarin sulfonate is of definite composition and stable in acid solution. The reaction is almost specific for zirconium and can be used for its determination in magnesium alloys, iron and steel, and minerals. A rapid method for determining the approximate composition of hafnium-zirconium salt mixtures is also indicated. The method compares favorably in accuracy, speed, and cost with the standard gravimetric procedure.

577. MAYKUTH, D. J. Metallurgy and Utility of the Less Common Metals. Metals Rev., vol. 22, No. 2, February 1949, pp. 5-8.

Recent developments in the less common metals are discussed. Included is a survey of zirconium.

578. McADAM, D. J., JR., AND GEIL, G. W. Rate of Oxidation of Typical Nonferrous Metals, as Determined by Interference Colors of Oxide Films. Nat. Bureau of Standards Research Jour., vol. 28, May 1942, pp. 593-635.

By means of interference colors the rates of oxidation were determined for 18 nonferrous metals and were compared with those for typical steels. The influence of temperature oxidation time, and film thickness on the rate of oxidation is illustrated by projections of surface in three-dimensional diagrams. The diagrams for the nonferrous metals are similar to those for steels. For a constant film thickness, the relation between temperature and oxidation time is linear logarithmic. The variation of film thickness with either temperature or oxidation time, plotted logarithmically, is represented by a reversed curve. A discussion is given of the influence of the affinity of the metal for oxygen and of the rate of diffusion through the oxide film. The film behaves as if the specific resistance varies nonlinearly with the film thickness.

579. McBRIDE, J. P. Extraction of Hafnium From Nitric Acid Solutions With Thenoyl Trifluoracetone. Oak Ridge Nat. Lab., AECU-399, Aug. 9, 1949, 18 pp.

Presents data that indicate that the extraction of Hf from 0.5 to 3.5 M HNO_3 with TTA has a third power dependence on hydrogen ion and a fourth power dependence on TTA corresponding to the equation $Hf(OH)_A^{+3} + 4HT_B = HfT_{4B} + 3H_A^+ + H_2O$. The small deviations from fourth power dependence on TTA are explained by the formation of an aqueous soluble Hf-TTA complex by the reaction $Hf(OH)_A^{+3} + HT_B = HfT_A^{+3} + H_2O$ with an equilibrium constant, k_t, equal to 15.5. An apparent or effective value for the molar hydrogen ion activity coefficient, $f_c'(H^+)$ has been calculated for use in calculations involving the extraction of Hf from HNO_3 with TTA, which may be of use in calculations involving the extraction of other metallic species from HNO_3 with TTA. A semiempirical

Generated on 2024-09-20 18:03 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

expression has been derived for the calculation of the distribution ratio of Hf between benzene phases 0.005 to 0.1 M in TTA and aqueous phases 0.5 to 3.5 M in HNO_3.

McCABE, C. I. See abs. 429.

McCLAIN, J. H. See abs. 866.

580. McCULLOUGH, J. D., BREWER, L., AND BROMLEY, L. A. Crystal Structure of Zirconium Oxysulfide; ZrOS. University of California, 1947, 5 pp. MDDC-1165.

The crystal structure of ZrOS has been investigated by X-ray powder photographs and by powder spectrometry. The substance has a simple cubic lattice, with a_o = 5.685 ± 0.002 A with space-group T^4-$P2_13$. In the resulting structure, Zr shows a coordination number of 7, being surrounded by 3 sulfur atoms at 2.63 Å, 1 sulfur atom at 2.61 Å, and 3 oxygen atoms at 2.13 Å. The coordination polyhedron has a point-group symmetry of C_{3v} -3m.

581. McCLUTCHEN, R. L., AND SUSANO, C. D. Effect of Fluoride on the Gravimetric Determination of Zirconium in Zirconium Fluoride. Carbide and Carbon Chem. Co., June 3, 1952, 20 pp. ORNL-1307; AECD-3422.

The results of this investigation show that it is necessary to remove fluoride before precipitating zirconium with mandelic acid or phenyl arsonic acid. Fluoride, however, has little effect on the cupferron method of precipitation. The discovery that zirconium fluoride is soluble in a mixture of aqua regia and sulfuric acid made it possible to dissolve the material without adding fluoride from hydrofluoric acid.

582. McDONALD, J. C. New Metallurgical Techniques and New Alloys of Magnesium. Metal Prog., vol. 52, No. 2, August 1947, pp. 243-248.

This is the concluding part of a paper read before the Western Metal Congress. The author describes improved etchants that develop grain size and distinguish between tiny casting voids and microporosity and also can correlate the composition, ultrafine structure and corrosion behavior. New alloys with zirconium and cerium have been studied extensively; the latter have unusual strength at moderately elevated temperatures.

McDONALD, L. A. See abs. 543, 544.

McDONNELL, F. F. See abs. 193.

583. McGEARY, R. K., AND LUSTMAN, B. Kinetics of Thermal Reorientations in Cold Rolled Zirconium. Jour. Metals, vol. 5, No. 2, February 1953, pp. 284-291.

Orientation relationships and rates of annealing of 97 percent rolled zirconium have been studied by X-ray techniques, metallography, and by hardness measurements. The process of annealing occurring by the formation of domains and their subsequent growth without recrystallization is demonstrated.

584. _____. Preferred Orientation in Zirconium. Westinghouse Atomic Power Div., WAPD-8, Mar. 10, 1950, 26 pp. AECD-2951.

The preferred orientation produced in zirconium when subjected to the following treatments has been investigated: Various types of cold-rolling deformation, cross-rolling, hot-rolling, recrystallization below the transformation temperature, and heating above the transformation temperature. Crystal bar and Bureau of Mines ingot zirconium show very similar textures. All above textures of zirconium differ fundamentally from those of magnesium and beryllium, the other close-packed hexagonal metals of similar axial ratio. The cold-rolling and hot-rolling textures are similar, although the cold-rolled material has a much sharper orientation than the hot-rolled material. Cross rolling produces a different

Generated on 2024-09-20 18:10 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

texture than is produced by other rolling deformations. The deformation textures change to new textures when the material is heated so as to cause recrystallization. The crystallographically reversible phase transformation of zirconium causes a new type of preferred orientation when the metal is heated above the α-β transformation temperature.

McGUIRE, T. R. See abs. 502.

585. McHARGUE, C. J. Crystallographic Angles for Titanium and Zirconium. Jour. Metals, vol. 4, No. 6, June 1952, p. 660.

Crystallographic data on zirconium and titanium is given in table form.

586. _____. Crystallography of the Titanium Transformation. Acta Cryst., vol. 6, 1953, pp. 529-530.

The orientation relationships between hexagonal close-packed and body-centered cubic titanium have been found to be (0001) h.c.p. parallel to (110) b.-c.c. and /1120/ h.c.p. parallel to /111/ b.-c.c. These were determined by noting the relationships between several large α grains that had been formed from a single β grain. These relationships agree with those reported for zirconium and lithium. The habit plane of titanium has been shown to be (331)b.-c.c. within an experimental error of 2°. This was determined from the relief effect present in large α grains and the orientation relationships developed above.

McKINNEY, D. S. See abs. 625, 626, 626, 627, 628, 629, 630.

McLAY, A. B. See abs. 587.

587. McLENNAN, J. C., McLAY, A. B., AND GRAYSON, H. Atomic States and Spectral Terms. Proc. Roy. Soc. (London), ser. A, vol. 112, 1926, pp. 76-94.

The chief characteristics of optical spectra of a number of elements are covered.

McOMIE, J. F. See abs. 696.

McPHERSON, D. J. See abs. 167, 168, 554.

588. McPHERSON, D. J., AND HANSEN, M. System Zirconium-Aluminum. Armour Research Found., Apr. 8, 1953, 18 pp.

The complete phase diagram of the zirconium-aluminum system was established by metallographic analysis of arc-cast and heat-treated specimens, X-ray diffraction, incipient melting and thermal analysis studies. Protective helium or argon atmospheres or vacuum were employed for melting and heat treatment operations.

McQUARRIE, M. C. See abs. 657.

589. McQUILLAN, M. K. Survey of the Constitutional Diagram of Chromium-Zirconium System. Aeronau. Research Lab., Australia, Sm. 165, January 1951, 12 pp.

Following a recent survey of the chromium-titanium system, a study of the binary chromium-zirconium alloys has been made. It has been found that the same factors influence the two systems and that the observed differences between them are due to the difference between the diameters of the zirconium and titanium atoms. The type of constitutional diagram to be expected for the chromium-zirconium system as a result of the observations made on the chromium-titanium alloys is in agreement with the experimental findings. The high-zirconium alloys show a possibly useful combination of hardness and machinability at room temperatures.

590. McVAY, T. N. Investigation of Some of the Optical Properties of Zirconium and Hafnium Compounds. Oak Ridge Nat. Lab., Sept. 5, 1950, 8 pp. Y-668.

The optical properties of zirconium tetrafluoride were determined and are given. Some samples purporting to be

Generated on 2024-09-20 18:12 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

zirconium oxyfluoride and hafnium oxyfluoride where shown to be mixtures and the refractive indices of some of the other crystals present, other than the tetrafluorides, are given. Directions for optical examination of these samples are detailed.

McVEY, W. H. See abs. 126.

MEAKER, C. L. See abs. 362.

591. MECHANICAL WORLD. Electrodeposition From Non-Aqueous Solutions. Vol. 133, No. 3411, October 1953, p. 445.

Present demand is strong for electrodeposited pure coatings of such metals as zirconium, molybdenum, tungsten, titanium, beryllium, and aluminum. Studies are being conducted on zirconium.

MEGAR, G. H. See abs. 377.

592. MEGGERS, W. F., AND KIESS, C. C. Infra-Red Arc Spectra Photographed With Xenocyanine. Nat. Bureau of Standards Research Jour., vol. 9, 1926, p. 309-326.

A new sensitizing dye, xenocyanine, has made possible the preparation of plates highly sensitive to infra-red light ranging in wave length from 8,000 to 11,000 A. With such plates the infra-red arc spectra of about 50 elements have been observed at the Bureau of Standards. New wavelength measurements have been made for Ti, Fe, Co, Ni, and Zr and are presented in this paper. Many of these new lines have been accounted for as combinations between previously known terms of the neutral atoms. In the case of Ti, a new term, $a\ ^5D$, has been found. Both Ti and Fe are rich in strong lines in the region investigated and are recommended as suitable comparison spectra for the measurement of wave lengths in the infra-red.

593. MEGGERS, W. F., AND SCRIBNER, B. F. Second Spectrum of Hafnium (Hf II). Nat. Bureau of Standards Research Jour., vol. 13, November 1934, pp. 625-657.

New data (wavelength measurements and intensity estimates) for more than 1,000 lines characteristic of singly ionized hafnium atoms, including Zeeman patterns for 207 lines, are presented. Analysis has resulted in the interpretation of 802 lines as combinations of 117 atomic energy states, most of which are grouped and identified as doublet or quartet spectral terms. The normal state of the Hf+ion is represented by a doublet-D term arising from the electron configuration $5d\ 6s^2$, and a tentative value of 14.8 volts is derived for the ionizing potential. Attention is called to the extraordinary similarity between LaI and HfII spectra.

594. MEHL, R. F., AND DERGE, G. Electrochemical Studies of Non-Aqueous Melts, Quarterly Progress Report, Period Ending October 1, 1952. Carnegie Inst. Technol., Dec. 31, 1952, 22 pp. NYO-3692.

Using the four-terminal conductivity cell and A.C. potentiometer circuit described in Quarterly Progress Report NYO-826 and the experimental method discussed in Quarterly Progress Report NYO-828, the electrical conductivity measurements of molten mattes from the liquidus (- 1,000° C.) to 1,500° C. were extended to cover the entire Cu_2S-FeS composition range. The data show positive temperature coefficients of conductance for all but the systems most rich in FeS and further electrolysis experiments indicate that the conduction is electronic. Current efficiency has been measured for the entire range of melts between iron oxide and the silica saturated slag. All compositions show some ionic conductivity, but the proportion of this type of conductance increases with the concentration of silica. Using an electrolysis apparatus and method similar to those described in Quarterly Progress Reports NYO-827, 828, and 3690, the decomposition potentials of $HfCl_4$ and $ZrCl_4$ were measured to be > 2.4 volts and 2.0 volts, respectively.

Generated on 2024-09-20 18:03 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

MEHROTRA, R. C. See abs. 67, 68, 70.

595. MEIER, J. W. ZK61 - High-Strength Magnesium Casting Alloy. Modern Metals, vol. 5, No. 12, January 1950, pp. 26-28. Canadian Bureau of Mines.

There has been considerable interest shown in the new magnesium-zirconium alloys (both cast and extruded) that aircraft firms are currently using. This article, taken from a paper presented at the Magnesium Association meeting in Niagara Falls, broadly discusses these developments and gives a summary of results.

596. MEIER, J. W., AND MARTINSON, M. W. Development of High-Strength Magnesium Casting Alloy ZK61. Trans. Am. Foundrymen's Soc., vol. 58, 1950, pp. 742-775.

An extensive investigation of various casting alloys based on the Mg-Zn-Zr alloy system showed that optimum mechanical properties in the as-cast and the heat-treated conditions are obtained using alloy ZK61 containing 6 Zn and over 0.7 Zr. The use of high-purity magnesium in the production of ZK61 alloy castings allows the use of a fused chloride mixture as an alloying agent for the introduction of zirconium without excessive flux inclusions. The use of high-purity magnesium gives a higher alloying efficiency because less zirconium is lost owing to settling out impurities. A heat treatment was developed for alloy ZK61 castings, consisting of a short solution treatment at high temperatures (425° to 500° C.) (800° to 932° F.) and a longer aging treatment at low temperatures (at or below 150° C.) (300° F.). Aging at room-temperatures, without any prior heat treatment, produces in ZK61 alloy castings a combustion of mechanical properties superior to those of any standard magnesium casting alloy in the fully heat treated (HTA) condition. A comparison of mechanical properties of various ferrous and nonferrous casting alloys shows that the newly developed magnesium casting alloy ZK61 has the highest strength-to-weight radio found in any commercial casting alloy.

MEISINGER, E. E. See abs. 441.

MELA, H., JR. See abs. 932.

597. MELBYE, C. E., PARKER, B. H., AND PARSONS, M. C. Economic Geology of the New Metals. Mines Mag., March 1953, pp. 61-66. Pres. at Colorado Min. Assoc. Convention, Denver, Colo., Feb. 12, 1953.

This is a discussion of several new metals including zirconium and hafnium. Zirconium is more plentiful in the earth's crust than such common metals as copper, lead, and zinc. The common minerals are zircon and baddeleyite. The supply of zirconium is now limited, although domestic consumption is being increased. Properties, uses, and processes are discussed.

598. MELLOR, G. A. Constitution of Magnesium-Rich Alloys of Magnesium and Zirconium. Jour. Inst. Metals, vol. 77, 1950, pp. 163-174.

An investigation into the constitution of magnesium-zirconium alloys containing up to 0.7 percent zirconium is described. During the experimental work true equilibrium conditions were difficult to establish owing to: (1) The high vapor pressure of magnesium, (2) the chemical activity of zirconium, and (3) the presence of inclusions. It was found that the liquidus rises 1.5° C. from the melting point of pure magnesium at 649° C. to a peritectic horizontal. From a peritectic point at approximately 0.5 percent zirconium the liquidus rises steeply, passing through 800° C. at 0.6 percent zirconium and 900° C. at 0.6 percent zirconium. The solid solubility appears to be about 0.3 percent at 300° C., 0.4-0.5 percent at 400° C., and over 0.6 percent at 500° and 600° C.

MENDENHALL, R. I. See abs. 565.

599. MERCER, D. Australia's Coast is Rich in Mineral Sands. Canadian Min.

Generated on 2024-09-20 18:03 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Jour., vol. 69, May 1948, pp. 94-95.

A survey of Australia's mineral sands including zircon is given.

MERLINI, A. See abs. 45.

600. MERRIMAN, A. D. Making and Using Zirconnium. Metal Progress, vol. 62, No. 6, December 1952, pp. 162, 164, 166.

A general survey and discussion of zirconium literature.

601. _____. Metallurgy of Zirconium. Metal Treat. and Drop Forging, August 1952, pp. 365-371.

The methods of extraction and properties of a metal, zirconium, which has only recently been produced in quantity, are given with some present uses and its future potentialities. The latter, as in the case of titanium, are limited by high cost and difficulty of extraction in spite of the metal's abundance in the earth's crust.

602. _____. Metallurgy of Zirconium. Metal Treat. and Drop Forging, September 1952, pp. 413-417.

In the concluding part of this article, the author discusses the workability of zirconium metal and the factors influencing this property. Corrosion properties and potentialities of zirconium as an alloying element are given, and some of the present day applications are mentioned.

603. METAL PROGRESS. Designers' Introduction to Zirconium. Product Engineering 1954 Annual Handbook, 1954, pp. B8-B12. (This article was prepared from two papers presented at a seminar of the Am. Soc. Metals and reprinted in Metal Progress: (1) Hayes, E. T., and Stephens, W. W. The Metallurgy of Zirconium, May 1953, p. 97. (2) Schwope, A. D. A Comparison of Zirconium with Better Known Commercial Metals, May, 1953, p. 75.)

This report describes the physical and mechanical properties of this titanium-like metal, including alloying tendencies and applications.

604. _____. Metallurgy of Zirconium. Vol. 58, No. 3, September 1950, pp. 380, 382, 384. (Excerpts from Research Activities of the Bureau of Mines in the Northwestern States, by H. A. Doerner, a paper read before the Eng. Research Council of the Soc. for Eng. Education, June 19, 1950.)

Zirconium, formerly limited to use under fragile conditions, has been developed to one of usage under adverse conditions by the Kroll process. This paper presents the development of zirconium through all stages, its properties, metallurgy, and uses.

605. METALLURGIA. New Electron Magnesium-Zirconium-Zinc-Thorium Casting Alloy. Vol. 46, No. 275, September 1952, pp. 145-146.

In 1946 Magnesium Elektron, Ltd., developed a commercial process for alloying zirconium with magnesium without introducing chloride contamination. The use of the powerful grain-refining properties of zirconium upon magnesium made possible the preparation of a series of alloys containing zirconium, zinc, and the rare earth metals that possessed physical and mechanical properties beyond anything before obtainable from magnesium alloys. The development of jet engines increased the demands for special alloys that led to the use of the magnesium-zirconium-thorium alloy.

606. METZ, D. B., AND WOODS, H. W. Attack-Polish Method of Metallographic Preparation. Sylvania Elec. Prod., Inc., SEP-42, Oct. 30, 1950, 11 pp.

A new method has been developed for preparing all types of metallographic specimens. This method has been found to be exceptionally good for massive samples of sintered materials, as well as for fine wire and extremely small samples. The procedure consists of a

Generated on 2024-09-20 18:09 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

conventional mechanical polish up to 2/0 or 3/0 jewelers' paper, followed by wheel polishing using a mixture of a common etchant and polishing powder. This etch-polish method was first used on tungsten and has now been successfully applied to uranium, beryllium, and zirconium.

607. MEYRE, H. C. Economics of Some of the Less Familiar Elements. Ind. Eng. Chem., vol. 30, No. 4, April 1938, pp. 431-436.

The less familiar elements comprise a group of some 20 or more. A number of them are still of minor importance industrially. None of the less known elements discussed, for example, zirconium, are rare from the standpoint of abundance. On the other hand, such familiar elements as gold, silver, and platinum are among the lowest in the scale of abundance and rightly should be classified as rare, although we have been accustomed to think of lithium or beryllium as belonging to the rare category. The economics of such metals are discussed in this report.

608. MICHAELSON, H. B. High Temperature Materials for Vacuum Service. Materials and Methods, vol. 38, No. 6, December 1953, pp. 110-115.

Special properties required of materials for service in a vacuum include low vapor pressure, stability, low gas permeability, and ease of outgassing. This report covers various metals from these standpoints.

609. MIDDLETON, A. R. Reaction of 'Aluminon' With Hydroxides of Beryllium, Rare Earths, Zirconium, and Thorium. Jour. Am. Chem. Soc., vol. 48, No. 8, August 1926, pp. 2125-2126.

Middleton describes the application of the reagent aluminon to the detection of aluminum. He records that lakes are formed with the hydroxides or basic acetates of beryllium, yttrium, lanthanum, cerium, neodymium, erbium, zirconium, and thorium. The color and other properties of the lakes are given.

MILES, G. L. See abs. 33.

610. MILLER, E., TUTTLE, M., AND BENNETT, D. G. Study of the Physical Changes Taking Place on the Cyclic Heating and Cooling of Several Zircon Bodies. University of Illinois, Feb. 27, 1948, 17 pp. NP-224.

Data is given concerning the mechanical failure on cyclic heating and cooling of zircon bodies. Body composition and information pertaining to the method of preparation of specimens for testing is given. Specifications for a thermal shock-testing unit and the procedure for its use are discussed. The effect of cyclic heating and cooling on some physical properties of zircon bodies is discussed. Presents a microscopic method for studying surface changes of zircon bodies using replicas. Correlation of microscopic cracks with thermal breakdown and changes in strength of zircon bodies on cyclic heating and cooling is covered.

611. MILLER, E. C. Metal Zirconium and Its Place in Nuclear Power Plants. Metal Progress, vol. 63, No. 5, May 1953, pp. 67-74. Pres. at Western Metal Cong., ASM, Los Angeles, March 1953.

A discussion of the various problems incidental to the development of atomic power from nuclear fission, particularly from the standpoint of the nuclear, chemical, and mechanical requirements of the potential structure materials such as zirconium. Discusses activities in the zirconium program being carried on by the Oak Ridge Laboratory and the Electromagnetic Production Facility.

612. MILLER, G. L. Applied Vacuum Metallurgy, The Production of Magnesium, Calcium, Tantalum and Zirconium. Vacuum, vol. 11, No. 1, January 1952, pp. 19-32.

Generated on 2024-09-20 18:03 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Describes the use of vacuum in producing specific metals on an industrial scale. Details of the processes used for the production and treatment of magnesium, calcium, tantalum, and zirconium are given. The work described indicates that the improvements in vacuum equipment together with the experience that has been gained by metallurgical engineers will lead to a rapid development of vacuum metallurgical techniques.

613. MILLER, G. L. Commercial Uses of Zirconium Developing. Iron Age, vol. 167, May 17, 1951, pp. 83-87.

Current world production of ductile zirconium as far as is known is confined to the Federal Bureau of Mines, Oregon; Foote Mineral Co., Philadelphia, Pa., and Murex Ltd., Rainham, England. Virtually all of the American production is by the Atomic Energy Commission, so that the British have been the first to offer the metal to industry in quantities sufficient to determine its commercial possibilities. Some zirconium metal powder has been produced in Germany by reducing potassium zirconium fluoride with sodium, but no one has claimed the production of ductile metal from this powder nor from that produced by the calcium reduction of zirconium dioxide.

614. MILLIGAN, L. H. Stabilized Zirconia a Pure Oxide Refractory. Brick and Clay Record, vol. 118, No. 5, May 1951, p. 52.

Zirconia is an inert refractory oxide of the metal zirconium and has two atoms of oxygen with each atom of zirconium, giving it the chemical formula ZrO_2. It will stand the highest temperatures and extends operating conditions beyond those previously available.

615. MILLS, G. A., BOEDEKER, E. R., AND OBLAD, A. G. Chemical Characterization of Catalysts, I. Poisoning of Cracking Catalysts by Nitrogen Compounds and Potassium Ion. Jour. Am. Chem. Soc., vol. 72, No. 4, April 1950, pp. 1554-1560.

A fundamental study has been undertaken to establish the essential chemical properties or active principles of a number of catalysts. The basic philosophy of this work is that very significant information about catalysts can be obtained from a study of the type and amount of various substances that react readily with catalysts. This paper describes a portion of the results of this study and more specifically is concerned with the reactions of nitrogen compounds and potassium ions with siliceous cracking catalysts and the effect of these substances on the activity of these catalysts.

616. MILLWARD, H. J. Founding Magnesium-Zirconium Alloys. Metal Industry, vol. 83, No. 5, July 31, 1953, pp. 83-85.

Coverage of magnesium-base alloys containing zinc and for rare earth metals and grain-refined with zirconium. Although research is being carried out on other compositions in the magnesium alloy field, zirconium additives have proved successful.

617. MILNER, G. W., AND SKEWIES, A. F. Analysis of Uranium-Zirconium Alloys. Atomic Energy Research Est., AERE C/R 1126, England, 1953, 14 pp.

Describes a satisfactory procedure for the analysis of uranium-zirconium alloys containing up to 25 percent zirconium. It is based on the separation of the zirconium from the uranium by dissolving the cupferron complex of the former element into chloroform. After the evaporation of the solvent from the combined organic extracts, the residue is ignited to zirconium oxide. The latter is then redissolved and zirconium is separated from other elements coextracted in the solvent extraction procedure by precipitation with mandelic acid. The zirconium mandelate is finally ignited to oxide at 960° C. The uranium is separated from the aqueous solution remaining from the cupferron extraction by precipitating with tannin at a pH of 8, the precipitate being removed by filtration

Generated on 2024-09-20 18:09 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

and then ignited at 800° C. The residue is dissolved in nitric acid and the uranium is finally determined by precipitating as ammonium diuranate and then igniting to U_3O_8.

618. MILNER, G. W., AND WOODHEAD, J. L. Analysis of Silver-Zirconium. Atomic Energy Research Est., AERE C/R 1170, England, May 6, 1953, 10 pp.

A suitable procedure is described for the analysis of silver-zirconium alloys covering the range in composition from 1-99 percent silver. The alloy is first dissolved in a mixture of hydrofluoric + nitric acids, and the solution then fumed with sulfuric acid, before being diluted to a definite volume with water. Aliquot portions of this solution are taken and the silver and zirconium determined separately. Silver is determined volumetrically by titration with standard ammonium thiocyanate in the presence of nitric acid using ferric ammonium sulfate as indicator. Zirconium is separated from the silver by precipitating as hydroxide with ammonia solution. This precipitate is redissolved in hydrochloric acid and the zirconium reprecipitated with mandelic acid, with subsequent filtration and ignition to the oxide at 960° C.

MINER, F. J. See abs. 233.

619. MISCH, R. D. Anodizing of Zirconium. Argonne Nat. Lab., October 1951, 26 pp. AECU-1701.

Many metals form oxide films as the result of anodic treatment. Aluminum is best known in this regard because of the need for enhanced corrosion resistance. Zirconium does not require the additional protection of a thicker oxide film but affords a contrast with aluminum in its response to anodizing variables. In this investigation the formation of anodic coatings on zirconium was studied as a possible means of evaluating factors affecting the corrosion of zirconium. Anodic coatings are greatly influenced by the preparation and composition of metals and alloys, but the significance of such factors in anodizing zirconium had not been determined. The use of another metal also makes possible a comparison of results with aluminum.

620. MISCH, R. D., AND RUTHER, W. E. Anodizing of Zirconium and Other Transition Metals in Nitric Acid. Argonne Nat. Lab., October 1952, 22 pp.; AECU-2310; Jour. Electrochem. Soc., vol. 100, No. 12, December 1953, pp. 531-537.

Zirconium was anodized in solutions of nitric acid and compared with certain other transition metals. At 1 ma/cm^2 zirconium was found to develop a low resistance oxide layer at concentrations of nitric acid exceeding 14 weight percent. Titanium, hafnium, columbium, tantalum, and tungsten showed a high resistance at this current even in 70 percent acid. Hafnium, however, produced a low resistance film at lower current densities. Zirconium showed periodic changes of resistance with time in nitric acid above 14 weight percent. It is postulated that nitric acid promotes the nucleation of oxide grains favoring permeation of electrolyte along grain boundaries. It is also suggested that a favorable orientation of oxide on metal is responsible for the ease of nucleation of oxide on zirconium and hafnium in contrast to the other metals. The diffusion of oxygen inward is believed to be the mechanism of film growth at the metal-oxide interface.

621. MITCHELL, A. C., AND BROWN, L. J. Note on the β and γ Energies of 65d Ar and 35d Nb by Coincidence Counting; chap. in Radiochem. Studies: The Fission Products, Nat. Nuclear Energy Series, McGraw-Hill Book Co., Inc., book 3, vol. 9, No. 5, New York, N. Y., 1951, pp. 717-718.

The 65d Zr emits γ rays of 0.60 Mev. A β-absorption curve of β-γ coincidences indicates β complexity with an inner end point of 0.40 Mev. The visual β-ray end point is 0.88 Mev. The 35d Cb has a γ-ray energy of 0.58 Mev.

Generated on 2024-09-20 18:05 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

MIYAMOTO, G. See abs. 762, 763.

MODAK, K. V. See abs. 705.

622. MODERN INDUSTRY. Another New Metal - Zirconium Gets Set for Large-Scale Production. Vol. 24, No. 2, Aug. 15, 1952, p. 13; also see Mod. Ind., June 15, 1948, p. 50; Mar. 15, 1952, p. 44.

Zirconium, a remarkably corrosion-resistant metal, did not assume the importance of its sister element, titanium. Titanium got the publicity and production build-up, but zirconium is now coming into its own.

623. _____. Atom Progress on Three Fronts. Vol. 26, July 15, 1953, p. 41.

Atomic energy has reached the point of being utilized for power in addition to other uses, such as in atomic weapons, chemical industry, etc. The general aspects of zirconium's use in atomic power is reviewed.

624. MODERN METALS. Zirconium for the Atomic Powered Submarine. Vol. 9, No. 4, May 1953, pp. 42, 44.

In spite of the difficulties involved in its production, zirconium seems assured of a good commercial future. If and when commercial atomic power becomes practicable, zirconium will be an indispensable material in the construction of nuclear reactors. Reason: It does not waste neutrons, the atomic particles that keep atomic fuel burning. Westinghouse Electric Corp. is now producing and fabricating zirconium for the nuclear reactors it is building for the first atomic-powered submarine.

MOHR, W. C. See abs. 755.

MONROE, G. S. See abs. 441.

625. MOORE, C. G., McKINNEY, D. S., AND WARNER, J. C. Progress Report for December 1949. Carnegie Inst. Technol., December 1949, 3 pp. NYO-543.

Progress made during the period of this report is given on measurements of hydrogen overvoltage in securing low-resistance contacts between mercury and zirconium. Experimentation in cathodic polarization characteristics of zirconium is discussed.

626. _____. Progress Report for March 1950. Carnegie Inst. Technol., March 1950, 10 pp. NYO-544.

Variations in surface impurities are believed to be the cause of the varying cathodic behavior of different specimens of titanium and zirconium. Drifts in hydrogen overvoltage with time are believed to be due principally to the formation of hydride at high-current densities and to the formation of an oxide film having high electrical resistance of low-current densities. Both metals show high enough hydrogen overvoltage that no additional corrosion difficulties should be experienced when they are joined to other metals.

627. _____. Progress Report for June and September 1950. Carnegie Inst. Technol., Dec. 10, 1950, 6 pp. NYO-545.

Presents experimental work and data for the cathodic polarization characteristics of titanium and zirconium in sulfuric acid. Experimental procedure, methods of analysis and pH determination are reported for the determination of the solubility of ZnO as a function of temperature and pH.

628. _____. Progress Report for December 1950. Carnegie Inst. Technol., Mar. 30, 1951, 5 pp. NYO-546.

The effect of sodium fluoride on the cathodic polarization characteristics is presented for zirconium in sulfuric acid. Describes construction of equipment and changes of procedures for the experiments on the solubility of ZnO.

629. _____. Progress Report for March 1951. Carnegie Inst. Technol., June 22, 1951, 18 pp. NYO-547.

Generated on 2024-09-20 18:02 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Experimental observations during the cathodic runs of titanium and zirconium indicated that the metal had undergone a chemical or physical change. Newbery was probably the first to point out that hydrides could be formed during the cathodic polarization of metals. He attributes hydrogen overvoltage to the formation, adsorption of hydrogen or diffusion of hydrogen through the metal can occur on cathodic polarization. X-ray diffraction analyses carried out on titanium and zirconium specimens subjected to cathodic polarization has shown that hydrides are formed. Titanium and zirconium specimens were made cathode in 2.06N H_2SO4 at 150 ma./cm.^{2} for 48 hours and the specimens mounted so that the X-ray beam struck the corner of the specimen. This was necessary because previous experience had shown that the hydride layer was relatively thin. The results of the X-ray analyses showed that for the titanium TiH_2 was present. Zirconium showed lines for both ZrH and ZrH_2.

630. ROTHMAN, A., McKINNEY, D. S., AND WARNER, J. C. Progress Report for January 1952. Carnegie Inst. Technol., June 1952, 10 pp. NYO-549.

This report covers the equilibrium study of the products in the corrosion of zinc and anodic and cathodic polarization of zirconium and titanium.

MOORE, G. E. See abs. 500.

MOORE, J. H. See abs. 165.

MOORE, M. F. See abs. 128.

MOORE, W. F. See abs. 383.

631. MOORE, W. J. Parabolic Oxidation Rates of Metals. Jour. Chem. Phys., vol. 18, No. 2, February 1950, p. 231.

Moore has tabulated the available data on the parabolic rate constants for metal oxidation in terms of the parameters of the transition state theory. The metals aluminum, iron, zirconium, titanium, nickel, copper, cobalt, zinc, and beryllium are included. A schematic diagram of the potential energy barriers for vacancy formation and vacancy diffusion is given. Inference is made that since a high heat of adsorption implies an imobile adsorbed film, it may also be associated with a large negative entropy or enthalpy of adsorption. The entropy or enthalpy of the diffusion process is high in the case of beryllium, suggesting an extended region of disorder around the diffusing vacancy or interstitial ion.

632. MOQUIN, W. N., and POOL, M. L. Artificial Radioactivity of Columbium and Zirconium. Phys. Rev., vol. 65, 1944, pp. 60-61.

An abstract of a paper on subject of artificial radioactivity of columbium and zirconium.

MORELAND, R. E. See abs. 86.

MORGAN, F. H. See abs. 328.

633. MORGAN, J. H., AND AUER, M. I. Optical, Spectrographic, and Radioactivity Studies of Zircon. Am. Jour. Sci., vol. 239, 1941, pp. 305-311.

Presents the results of spectrographic, radioactivity and optical studies of zircon. The variations in physical properties of zircon may be due to breakdown of the crystal lattice by the action of radioactive elements included at the time of crystal formation. It is suggested that the type of zircon present in a granite is governed by the concentration of uranium in the magma at the time of formation of the zircon crystals.

MORTIMORE, D. M. See abs. 253.

634. MORTIMORE, D. M., AND NOBLE, L. A. Determining Low Concentrations of Hafnium in Zirconium, a Spectrographic Method. Anal. Chem., vol. 25, February 1953, p. 296.

The demand within recent months for zirconium metal relatively free of hafnium has necessitated the development of

Generated on 2024-09-20 18:10 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

new spectrographic methods capable of detecting trace amounts of hafnium. A spectrographic method is presented for quantitatively determining hafnium in zirconium in concentrations of 0.003 to 0.4 percent. The method involves excitation of zirconium oxide samples in a direct current arc of 30 amperes at 230 volts, using a buffer to maintain a smooth arc stream. The third-order ultraviolet spectra are used to minimize the relatively high background encountered with zirconium excitation. The precision attained ranges from an average deviation of 13 percent at 0.006 percent hafnium to 4 percent at 0.4 percent hafnium. The sensitivity of this method is unusually good and the precision is satisfactory for a routine quantitative method.

635. MORTIMORE, D. M., AND ROMANS, P. A. X-ray Spectroscopy as a Control Method in the Production of Zirconium and Hafnium. Jour. Optical Soc. Am., vol. 42, No. 9, September 1952, pp. 673-677.

An X-ray spectrographic method has been developed for routine analysis of mixtures of zirconium and hafnium oxides in the range of concentrations from 0.5 to 99.5 percent hafnium in zirconium. The method makes use of the newly perfected X-ray fluorescence analysis equipment incorporating a Geiger tube together with associated scaling and recording circuits for measuring intensities. A single analysis requires 5 to 10 minutes to complete, including preparation of sample and final calculations. The average percent deviation at concentrations of 1 percent hafnium is 3.3 percent and at 40 percent hafnium about 0.5 percent.

MOSSMAN, R. A. See abs. 488.

636. MOTT, W. R. Relative Volatities of Refractory Materials. Trans. Am. Electrochem. Soc., vol. 34, 1918, pp. 255-295.

This is a study of the order in which substances volatilize in the electric arc, and the distances at which their vapors condense from the arc, and also of the time to volatilize equal atomic quantities of elements or molecular quantities of compounds. After discussing at length the experimental data and the conclusions to be drawn therefrom, some theoretical considerations are advanced concerning the ratios of absolute boiling points to melting points, and upon a universal vapor pressure curve applicable to all substances.

MOWRY, A. L. See abs. 661.

637. MUEHLENKAMP, G. T., AND SCHWOPE, A. D. Effect of Hydrogen on Mechanical Properties of Zirconium and Its Tin Alloys. Battelle Mem. Inst., BMI-845, June 30, 1953, 16 pp.

Hydrogen, in excess of 20 p.p.m., in zirconium and its tin alloys makes these materials behave in a brittle manner in the room-temperature notched-bar impact test. Increasing hydrogen contents, up to 500 p.p.m., increase the transition temperature. It lowers the tensile ductility slightly and has no apparent effect on the tensile-strength properties. The embrittling effect is eliminated by water quenching from above 600° F. if the hydrogen content is less than 60 p.p.m. The hydrogen content may be lowered enough by vacuum annealing to make zirconium tough in the notched-bar impact test at temperatures as low as -80° C.

MUELLER, M. H. See abs. 516.

638. MULLEN, T., AND TAUB, J. M. Fabrication of Ceramic Shapes. Los Alamos Sci. Lab., AECD-2936, Dec. 23, 1946, 11 pp.

This report gives some of the methods employed at Los Alamos for fabricating refractory products.

639. MURPHY, A. J., AND PAYNE, R. J. Magnesium-Cerium-Zirconium Alloys. Jour. Inst. Metals (London), vol. 73, November, 1946, pp. 105, 127.

Generated on 2024-09-20 18:03 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Sand-cast binary magnesium-cerium alloys containing about 3 percent cerium (mischmetall) possess good strength and resistance to creep at 200° C. They are not hot-short or liable to serious shrinkage troubles and cast well in sand moulds. Their mechanical properties at ordinary temperatures are, however, poor. By the adding of zirconium, alloys are obtained that have mechanical characteristics at room temperature comparable to those of the usual casting alloys Elektron A8 and AZ91 (specifications D.T.D.59A and 136A), but possessing resistance to creep of a far higher order. When tested at 200° C., the creep-resistance of certain of the magnesium-cerium-zirconium alloys is very little inferior to that of the widely used aluminum alloys of the type covered by specifications D.T.D.133c and 287. The combination of good casting qualities and good mechanical properties at ordinary elevated temperatures makes the magnesium-cerium-zirconium alloys attractive for some important light-weight stressed components of engines, for which magnesium-base materials have hitherto been unsuitable. The good creep-resistance of the magnesium-cerium-zirconium alloys is shared by the quaternary alloys formed by the addition of such elements as zinc and silver.

640. MYHILL, A. R. Industrial Uses of the Rarer Metals and Their Alloys. Mech. World, vol. 133, No. 3409, August 1953, pp. 353-357.

Research and technical development have opened for commercial utilization many metals formerly considered unsuitable for industrial use. Their uses and properties are considered.

641. NACHTRIEB, N. H., AND TOBIN, W. J. Spectrochemical Analysis of Columbium and Zirconium. Argonne Nat. Lab., December 1943, 7 pp. AECD-3103.

A method is given for the determination of zirconium in samples of columbic oxide and columbium in zirconium oxide.

NAMBO, J. See abs. 424.

642. NEDZEL, V. A. β-ray Spectrum of 65d Zr; chap. in Radiochem. Studies: The Fission Products, Nat. Nuclear Energy Series. McGraw-Hill Book Co., Inc., book 2, vol. 9, No. 5, New York, N. Y., 1951, pp. 719-721.

The radiations from the 65d Zr have been studied with the 180-deg β-ray spectrometer. Two continuous spectra of 0.39_4 Mev (98 percent) and 1.0 Mev (2 percent) have been found. Three conversion lines have also been found that correspond to γ rays of energies of 0.23_4, 0.73, and 0.92 Mev. with conversion electron yields of 0.21, 0.10, and 0.07 percent of the more abundant β groups.

NELSON, H. R. See abs. 563, 564.

643. NERESON, N., AND DARDEN, S. Average Neutron Total Cross Sections in the 3- to 12-Mev Region. Phys. Rev., vol. 89, No. 4, Feb. 15, 1953, pp. 775-785.

Describes an experiment for measuring average neutron total cross sections over the 3- to 12-Mev energy region. The neutron source is a collimated beam of fast neutrons emerging from the Los Alamos fast reactor and the detector is a proton recoil ionization chamber, which serves as a neutron spectrometer. The average energy spread of the measurements is around 10 percent, and the overall accuracy of the cross section determination is ± 10 percent or better. Total cross section results are presented for H, Be, C, O, Al, Si, S, Fe, Cu, Zr, Pb, Bi, and U. Neighboring elements above Fe are observed to exhibit regularities in their total cross section patterns.

NESTER, R. G. See abs. 338.

644. NEWBERRY, E., AND LUPTON, H. Radio-Activity and the Coloration of Minerals. Nature, vol. 101, No. 2532, May 9, 1918, p. 198.

Discusses results on a number of mineral specimens examined as to their

Generated on 2024-09-20 18:07 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

behavior on heating, on treatment with radium or cathode rays before or after heating, and on heating after treatment.

645. NEW BRUNSWICK LABORATORY. Analytical Results and Methods on Standard Samples and Zirconium Metal. Jan. 9, 10, 1950, 28 pp. NYO-2015. Pres. at Zirconium Conf., Jan. 9, 10, 1950, New Brunswick, N. J.

Gives spectrographic analysis of samples submitted to Foote Mineral, Bureau of Mines, Albany, Oreg., Iowa State College, National Spectrographic Laboratories, Westinghouse Electric, Oak Ridge and New Brunswick Laboratory.

646. NEWNHAM, I. E. Ion-Exchange Separation of Hafnium and Zirconium. Jour. Am. Chem. Soc., vol. 73, No. 12, December 1951, p. 5899. Commonwealth Sci. and Ind. Research, Australia.

A method is given for the separation of hafnium oxide from ZrO_2 and its application to grain-size samples.

647. NICHOLS, E. L., AND WILBER, D. T. Luminescence of Certain Oxides Sublimed in the Electric Arc. Phys. Rev., vol. 17, No. 6, 1921, pp. 707-717.

Oxides prepared by sublimation are found to respond to excitation by cathode rays as well as to flame excitation through a wide range of temperatures. The temperature at which excitation ceases is in general the same, taking each band separately, for flame excitation and for cathodo-excitation. The shift in the color of luminescence is in general towards the violet with rising temperature. This shift is produced by the independent growth and decadence of overlapping bands and not to any lateral movement of the bands themselves. Certain bands in the spectra of these oxides are most strongly excited by cathode rays at relatively high pressures, others appear as the vacuum becomes more complete, so that as exhaustion progresses there are marked changes in the color of luminescence.

NIELSEN, J. W. See abs. 32.

648. NIPPES, E. F. Copper-Nickel-Zirconium-Aluminum Alloys. Metals and Alloys, vol. 13, March 1941, pp. 294-300.

There is keen interest in the general subject of precipitation hardening. This article supplies added data in this field. The author finds that both aluminum and zirconium are very effective as hardeners in alloys of copper and nickel where the ratio is 3 to 1 and 1 to 1. For other copper:nickel ratios further investigation is still to be done. The hardening agent in these alloys may be a compound of aluminum and zirconium containing about 70 percent Al.

NISBET, J. D. Development of Zirconium Base Alloys. See abs. 387.

See also abs. 381, 382, 383, 384.

NOBLE, L. A. See abs. 634.

NOLAN, E. J. See abs. 787.

649. NORMAN, N. E., AND JOHNSTONE, H. F. Catalysis in Fused Salt Systems. Ind. Eng. Chem., vol. 43, No. 7, July 1951, pp. 1553-1558.

Catalysis by fused salts in the past has been confined to reactions such as Friedel-Crafts, polymerization, and halogenations. In all cases, the melts that have been used have a molecular structure. Ionic-type melts, never before investigated as catalysts, should have the same catalytic action as the corresponding metals in the free state. The object of this work was to study the fields of application of ionic and mixed-type melts as catalysts. Evidence is presented to show that melts containing metallic ions should catalyze reactions that are normally promoted by the corresponding metals in the free state. The effects of molten chlorides on the decomposition of acetylene, for example,

Generated on 2024-09-20 18:04 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

agree with the effects of the corresponding metals. Cuprous chloride exists as a partly ionized melt and behaves as a mixed catalyst in the dehydration and dehydrogenation of ethyl alcohol. Further information is needed on the degree of ionization of fused salts, because their application as catalysts is severely limited by their melting points and their reactivity with the common gases. No melt has yet been found that catalyzes the synthesis of hydrocarbons from carbon monoxide and hydrogen. Further studies are in progress on other types of melts that are ionic in nature.

NORMAND, C. E. See abs. 469, 470.

NORRIS, W. P. See abs. 768.

650. NORTON, C. L., JR., AND HOPPER, B. Notes on Reaction Between MgO and Various Types of Refractories. Jour. Am. Ceram. Soc., vol. 29, 1946, pp. 364-367.

Samples of high-heat duty, superduty, 60 percent Al_2O_3, 70 percent Al_2O_3, 80 percent Al_2O_3, 90 percent Al_2O_3, fused-alumina, kaolin base, kyanite base, chrome magnesite, silicon carbide, zircon, and chrome-magnesite compositions were tested for reaction with MgO at 2,200°, 2,600°, and 2,800° F. (1,205°, 1,425°, and 1,540° C.). Silicon carbide and zircon refractories showed a slight reaction at 2,800° F. and none at 2,600° F. or 2,200° F. Commercial grades of firebrick containing 60 percent or more of Al_2O_3 in contact with powdered magnesia showed no reaction up to 2,800° F.

651. NORTON, F. H. Thermal Expansion of Refractories. Jour. Am. Ceram. Soc., vol. 8, 1925, pp. 799-815.

The thermal expansion or contraction of a number of typical refractories has been measured up to 1,700° C. in a neutral or slightly oxidizing atmosphere. In nearly every case, the expansion curve has been carried to a higher temperature than given by previous data. In a few cases, the expansion curve has been obtained for materials that have not been studied in this way before. It is believed that the expansion curve of a brick, if carried to the softening point, gives valuable information as to the performance of that brick in service.

652. NORTON, F. H., AND KINGERY, W. D. Measurement of Thermal Conductivity of Refractory Materials, Progress Report. Massachusetts Inst. Technol., Oct. 1, 1953, 9 pp. NYO-3648.

The theoretical and experimental investigation of the effects of porosity on thermal conductivity have been completed. Summary reports on these subjects and a compilation of data for oxide materials have been submitted. Data for a glass composition, SiC and ZrN, are given. A topical report on the preparation and thermal conductivity of carbides and nitrides is being prepared.

653. _____. Study of Metal-Ceramic Interactions at Elevated Temperatures. Massachusetts Inst. Technol., Oct. 1, 1951, 14 pp. NYO-3136.

The study of metal-ceramic interactions at elevated temperatures will be carried out in three phases. Some progress has been made on metal-ceramic interfacial reactions and sintering studies. Methods for fabricating satisfactory pieces of carbides and nitrides for this study are being worked out. Surface tension and wettability relationships in a series of alloys are being studied, and methods and equipment for microscopically studying the sintering process at elevated temperatures are being studied.

654. _____. Study of Metal-Ceramic Interactions at Elevated Temperatures. Massachusetts Inst. Technol., Apr. 1, 1952, 65 pp. NYO-3139.

A review of the literature pertaining to carbide, nitride, and sulfide reactions with metals has been completed. Samples of nitrides and carbides have

Generated on 2024-09-20 18:03 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

been prepared for use in reaction and surface tension studies. Surface tension and wettability data for iron, nickel, and silicon on ceramic oxides has been reviewed and the results are summarized. Additional improvements and tests of a microscopic furnace for sintering studies have been completed and spherical particles of aluminum and zirconia prepared.

655. NORTON, F. H., AND KINGERY, W. D. Study of Metal-Ceramic Interactions at Elevated Temperatures. Massachusetts Inst. Technol., July 1, 1952, 5 pp. NYO-3140.

Additional samples of titanium carbide, titanium nitride and zirconium nitride have been prepared. Difficulties have been encountered with molybdenum carbide. Samples of Zr-ZrO_2 have been prepared to determine the phases present. The surface tension and wettability equipment has been reconditioned and is now in operation. Experimental data have been obtained for the sintering of Al_2O_3 spheres at various temperatures. These data are as yet incomplete.

656. _____. Study of Metal-Ceramic Interactions at Elevated Temperatures. Massachusetts Inst. Technol., Oct. 1, 1952, 21 pp. NYO-314.

During the present period additional surface tension measurements have been attempted with liquid copper by the sessile drop method and liquid Al_2O_3 by the pendant drop method. These results are as yet incomplete. By means of equilibrium interfacial angle measurements, estimates of the surface tension of solid Al_2O_3, ZrO_2 (stab.), and interfacial tensions with Ni have been estimated at 1,850° C. The interfacial and surface adsorption of silicon from iron-silicon alloys on Al_2O_3 and ZrO_2 are inconclusive owing to insufficient microscopic resolution and time measurements during the initial stages of the process.

657. NORTON, F. H., KINGERY, W. D., FELLOWS, D. M., ADAMS, M., McQUARRIE, M. C., COBLE, R. L., FRANCL, J., VALILOS, T., AND ANDERSON, H. H. Measurement of Thermal Conductivity of Refractory Materials. Massachusetts Inst. Technol., Jan. 10, 1951, 15 pp. NYO-597.

Measurement of thermal conductivity of a second sample of stabilized zirconia completes work on this material in the low and intermediate temperature ranges. Additional data have been obtained for alumina, magnesia, and insulating brick specimens. Construction of an inductively heated tester for the high temperature range has been completed. Preliminary tests of the equipment are underway at present. Design of a resistance heated tester for the high-temperature range is also underway. Design of a linear-flow apparatus for measuring thermal conductivity and the effects of porosity, etc., has been completed and construction is underway. In addition to alumina, zirconia, and magnesia, work has been initiated in the forming of other pure crystalline materials. Dense samples of pure mullite have been formed, and satisfactory casting procedures for zircon have been worked out. The synthesis and forming of pure crystalline spinel is being investigated.

658. NORTON, F. H. Measurement of Thermal Conductivity of Refractory Materials. Massachusetts Inst. Technol., Apr. 1, 1951, 10 pp. NYO-598.

Measurement of thermal conductivity of stabilized zirconia, alumina, and magnesia, as well as B and W K-28 insulating brick, has been completed. Recommended values have been included. Samples of BeO and mullite are being tested. A minor effect on the thermal conductivity of alumina on reheating seems to have been established. Investigation of the causes of this effect are underway. The effect of certain variables on thermal conductivity measurement has been investigated. An inductively heated tester is being tested. Preliminary tests of a resistance heated tester are underway. A linear flow tester has been constructed

Generated on 2024-09-20 18:55 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

and appears satisfactory. Methods of forming pure TiO_2, $MgAl_2O_4$, AnO, $ZrSiO_4$, and ZrN are being investigated.

659. NORTON, F. H., AND KINGERY, W. D. Measurement of Thermal Conductivity of Refractory Materials. Massachusetts Inst. Technol., July 1, 1951, 31 pp. NYO-599.

Thermal conductivity values of beryllia, mullite, and zircon have been determined up to 1,300° C. Thermal conductivities of Al_2O_3 and MgO have been determined from room temperature to 500° C. Errors involved in the ellipsoidal method of thermal conductivity determination have been reviewed. On the basis of reproducibility found, absolute values ±5 percent should be obtained. Additional equipment for use of a comparative method has been designed. A theoretical treatment of the effect of porosity on thermal conductivity has been completed. For the high-temperature range, use of W-lr thermocouples was found not feasible in the ellipsoidal method. Work has proceeded with the inductively heated tester. Work has continued with the forming of mullite, zircon, thoria, spinel, nitride, and carbide specimens.

660. _____. Measurement of Thermal Conductivity of Refractory Materials. Massachusetts Inst. Technol., Jan. 1, 1952, 52 pp. NYO-601.

Additional measurements of the thermal conductivity of thorium oxide, zirconium oxide, and an electrical porcelain for temperatures up to 1,300° C. are reported. A comparative method and equipment for measuring thermal conductivity of ceramic materials is reported. Thermal conductivity of Al_2O_3 has been determined at temperatures up to 1,750° C. by an ellipsodidal test method employing induction heating. The thermal conductivity of alumina decreases to about 1,400° C. and then increases quite rapidly - probably due to radiant heat transfer through the translucent materials. The theory of power measurement for induction heating and the literature regarding porosity are reviewed.

661. NORTON, J. T., AND MOWRY, A. L. Solubility Relationships of the Refractory Monocarbides, Tech. Report No. 1. Massachusetts Inst. Technol., August 1949, 19 pp. NP-902.

The monocarbides of the elements titanium, zirconium, vanadium, columbium, and tantalum are isomorphous and have a sodium-chloride-type structure. The binary carbide systems, Tic-ZrC, Tic-VC, TiC-CbC, TiC-TaC, ZrC-CbC, ZrC-TaC, VC-CbC, VC-Tac, CbC-TaC form continuous series of solid solutions. The binary carbide system ZrC-VC shows very small solubility, the limits at 2,100° C. being 5 percent at the zirconium-rich end and less than 1 percent at the vanadium-rich end. The parameter-composition curves show only slight deviations from Vegard's Law but both positive and negative deviations are found. The maximum size difference between atom diameters expressed in percent of the solvent atom diameter for extended solubility is 13 percent. The minimum value for very restricted solubility is 16 percent in the solid solution, the metal atoms are distributed at random on the points of the metal lattice.

NOTTORF, R. See abs. 753.

662. NOYES, A. A., BRAY, W. C., AND SPEAR, E. B. System of Qualitative Analysis for the Common Elements, Part III: Analysis of the Aluminum and Iron Groups, Including Beryllium, Uranium, Vanadium, Titanium, Zirconium, and Thallium. Jour. Am. Chem. Soc., vol. 30, No. 4, Jan. 28, 1908, pp. 481-563.

Two previous papers in this investigation dealt with the qualitative analysis of the silver, copper, and tin groups. This report (Part III) deals with the analysis of the precipitate produced by ammonium hydroxide and sulfide in the filtrate from the hydrogen sulfide precipitate. In addition to the common elements (nickel, cobalt, iron,

Generated on 2024-09-20 18:08 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

manganese, zinc, chromium, and aluminum) considered in almost all schemes of qualitative analysis, the rarer elements, beryllium, uranium, vanadium, thallium, titanium, and zirconium have been included. Details of procedures are given.

663. NUCLEONICS. Materials and Equipment for Reactors. Vol. 11, No. 6, June 1953, pp. 18-64.

The pertinent properties of many materials suitable for use in reactors and equipment are tabulated, and the general requirements of reactors are discussed under the headings materials, coolants, reactor operation, and radiation safety. The use of reactors for research and nuclear power is discussed, and the proposed power projects are described. A comprehensive bibliography is given for each topic discussed.

OBLAD, A. G. See abs. 615.

O'BRIEN, W. L. See abs. 370.

ODELL, F. See abs. 185, 186.

664. OESPER, R. E., DUNLEAVY, R. A., AND KLINGENBERG, J. J. Rapid Method for Determination of Small Amounts of Zirconium. Anal. Chem., vol. 24, No. 9, September 1952, pp. 1492-1494.

The present investigation was directed toward: (1) Synthesis of a suitable azo derivative of mandelic acid, (2) determination of the necessary conditions for the precipitation, (3) investigation of the interference of other elements, and (4) development of a usable procedure.

OGBURN, S. C., JR. See abs. 549.

665. OGLE, W. E. Thresholds for the Photo-Disintegration of Zr^{90}, Pr^{141}, As^{75}, I^{127}, Ni^{58}, and La^{138}. Los Alamos Sci. Lab., 1949, 20 pp. AECU-163.

The gamma-n thresholds of several elements have been determined using the 20 Mev betatron at Los Alamos by comparing the observed thresholds with the thresholds of N^{14} and F^{19}, where the threshold for the $N^{14}(\gamma,n)N^{13}$ reaction was taken as 10.54 Mev and the threshold for the $F^{19}(\gamma,n)F^{18}$ reaction was taken as 10.40 Mev. On this assumption the following values were obtained for the thresholds of the reactions quoted: $I^{127}(\gamma,n)I^{126}$ (9.45±0.2 Mev), $Pr^{141}(\gamma,n)Pr^{140}$ (9.8±0.3 Mev), $As^{75}(\gamma,n)As^{74}$ (10.3±0.2 Mev), $Zr^{90}(\gamma,n)Zr^{89}$ (12.0±0.2 Mev), $Ni^{58}(\gamma,n)N^{57}$ (11.7±0.2 Mev), $La^{138}(\gamma,n)La^{137}$ (12.9±0.4 Mev).

666. O'KELLEY, G. D. Spectrometric Determination of Some Beta Particle and Conversion Electron Energies. Radiation Lab., University of California, UCRL-1243, Mar. 15, 1951, 97 pp.

A double focusing beta spectrometer having a radius of 25 cm. has been constructed. The theoretical transmission for a resolving power of 1-1/3 percent is about 1 percent of 4π. The spectrometer and auxiliary equipment are described. The decay of Am^{242} has been investigated, using the beta spectrometer, and a decay scheme is postulated. Schemes are also proposed for the decay of Am^{241}, Cm^{242}, Np^{236}, and Pb^{203}. The radiations of the heavy nuclides Np^{234}, Pu^{243}, Pu^{238}, Pb^{209}, and Pb^{200} have also been measured. The radiations from neutron deficient isotopes of zirconium and their decay products have been determined and a decay scheme is postulated for the decay of Zr^{87}.

See also abs. 446.

667. ORR, R. L. High Temperature Heat Contents of Hafnium Dioxide and Hafnium Tetrachloride. Jour. Am. Chem. Soc., vol. 75, 1953, p. 1231.

High-temperature heat contents of hafnium dioxide and hafnium tetrachloride were measured from 298.16° K to 1804 and 486° K, respectively. A table of smooth heat content and entropy increment data above 298.16° K was compiled and heat content equations representing the data were derived.

Generated on 2024-09-20 18:04 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

668. ORTON, G. W. Magnesium Alloys Containing Zirconium. Foundry, vol. 78, No. 12, December 1950, pp. 95, 156, 158.

In investigating methods for introducing zirconium into magnesium, the author reports the best results were achieved by using zirconium salts. Mechanical properties of the magnesium-zinc-zirconium alloys are described as appreciably better than those of alloys commercially available today.

OVERSTREET, R. See abs. 343, 448, 800.

OWENS, H. S. See abs. 879, 880.

669. OWENS, H. S., AND TORGESEN, J. L. Zirconate Sol Formation - Its Dependence Upon the Displacing Power of Anions. Jour. Am. Chem. Soc., vol. 60, 1938, pp. 264-265.

The aquo displacing order is so much like the peptizing order in zirconate sol formation to make it more than coincidental and indicates that the Thomas theory of colloidal oxides can be used to predict negative sol formation nearly as well as positive sol formation. Aging the oxide makes it more refractory. The alpha hydroxy anions seem to chelate yielding hydrogen ions in the colloidal solution.

OWENS, W. H. See abs. 483.

OWINGS, A. M. See abs. 283, 284.

PAASCHE, O. G. See abs. 371.

670. PAASCHE, O. G., AND KILLEN, A. J. Fabrication of a Zirconium Lined Reaction Vessel. Welding Jour., vol. 33 No. 2, February 1954, pp. 115-118; Engineering Experiment Sta., Oregon State College Reprint 49, 1954, 7 pp.

With the development of the Kroll process for production of ductile zirconium by the Federal Bureau of Mines, the metal has become available in relatively large quantities for use as a structural material. The Bureau station at Albany, Oreg., has become a large-scale producer of the metal and is continuing research on improved methods of production, fabrication and use of zirconium. During researches on process improvements, it became necessary to construct a reaction vessel, which, because of the highly corrosive nature of the reaction products, necessitated the use of a corrosion resistant lining. Partly because of its excellent corrosion resistance and partly because of the availability of the metal to the Bureau station, zirconium was selected as the lining material. All the zirconium used in the fabrication of the vessel was produced, melted and rolled to sheet at the Bureau plant.

671. PADGETT, E. D. New Unit Speeds Analysis Work. Alfred University, Feb. 14, 1952, 6 pp. NP-3828.

An X-ray diffraction unit now in operation at Alfred University permits rapid quantitative analysis by its direct recording method.

672. PAINT MANUFACTURE. Zirconium Purification. Vol. 23, No. 1, January 1953, pp. 3-4.

Discussion of a rapid method for freeing zirconium of common impurities as developed by the National Bureau of Standards.

PALKO, A. A. See abs. 509.

673. PALMER, F. R. New Chromium Steel Contains Zirconium Sulfide. Steel, vol. 87, No. 4, July 24, 1930, pp. 50-54.

Recent experiments have determined that the addition of about 0.40 percent of zirconium sulfide to a 14 percent chromium steel of the corrosion-resisting-type facilitates the machining, grinding, and polishing of the steel virtually to the extent of commercial screw stock. The accompanying article describes, tabulates and illustrates some of the properties brought about by

Generated on 2024-09-20 18:08 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

adding the sulfide to this type of steel.

PAPP, C. A. See abs. 563, 564.

PAPUCCI, R. A. See abs. 491.

674. PAPUCCI, R. A., FLEISHMAN, D. M., AND KLINGENBERG, J. J. Determination of Zirconium in Aluminum Alloys. Anal. Chem., vol. 25, No. 11, November 1953, pp. 1758-1760.

Zirconium in aluminum alloys can rapidly and conveniently be determined gravimetrically by the mandelate method. The use of p-chloro- or -bromomandelic acid is preferred to mandelic acid. No significant difference exists between the chloro and bromo derivative.

PARKER, B. H. See abs. 597.

675. PARKER, E. R. High Temperature Properties of the Refractory Metals. Trans. Am. Soc. Metals, vol. 42, 1950, pp. 399-404.

There are 14 metals having melting points above 3,200° F., including 5 of the precious metals. The melting points, densities, and known room temperature mechanical properties have been tabulated for these metals along with the corresponding properties for iron and nickel for comparison. Little work has been done to determine the high-temperature properties of the refractory metals, and most of the results are either incomplete or as yet unpublished. Data presented in this paper have been collected from the literature and from private sources. The entire field is covered in this general survey.

PARSONS, M. C. See abs. 597.

676. PARTRIDGE, F. J., AND BUSBY, T. S. Improved Materials for Tank Blocks. Refractories Jour., vol. 29, No. 6, June 1953, pp. 237-240.

The desired properties of tank blocks are discussed together with ways to improve tank-block material for glass making. Gives melting points for 11 refractory oxides, and the corrosion resistance and rate of creep of 6 types of blocks. Zirconia and alumina spinels are discussed. Their corrosion rates are as low as 7 percent of that for fire clay in the case of alumina and 8 percent for zirconia blocks. Availability, cost, and firing temperature limit the choice of materials to oxides of silicon, aluminum, manganese, zirconium, chromium, and calcium for most operations.

677. PATTON, W. G. Rare Earths Boost Creep Resistance of Mg-Zr Alloys. Iron Age, vol. 169, No. 21, May 22, 1952, pp. 134-136.

Finding alloys with high strength-weight ratios and ability to meet increasing stresses at elevated temperatures for aircraft applications has confronted engineers and metallurgists. Alloys must be capable of handling in the foundry. Now, by adding 2 to 4 percent rare earths to Mg-Zr alloys, Dow Chemical has come up with new metals with outstanding high-temperature properties.

678. PAUL, F. W., AND RENSE, W. A. Spectra of Y V and Zr VI. Phys. Rev., vol. 56, Dec. 1, 1939, pp. 1110-1113.

The Br I isoelectronic sequence has been extended to Y V and Zr VI. Spectrograms covering the region from 150A to 1000A were obtained with a three-meter grazing incidence vacuum spectrograph having a dispersion of 1.0A/mm. at 500A. The separations of the ground doublets $4s^24p^5$ were predicted by the regular doublet law and observed to be 12,068 cm^{-1} for Y V and 15,600 cm^{-1} for Zr VI. With the aid of the irregular doublet law and Moseley diagram curves, most of the expected $4s4p^6$, $4s^24p^44d$ and $4s^24p^45s$ levels with $i \leq 5/2$ were found. Forty-two lines of the spectrum of Y V, and 46 lines of the spectrum of Zr VI have been classified. The absolute term values of the $^2P^0 3/2$ ground levels of Y V and Zr, VI were estimated to be 620,000 cm^{-1} and 798,000 cm^{-1}, respectively.

Generated on 2024-09-20 18:01 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

PAULING, L. See abs. 346.

679. PAYNE, R. J. Stress Relief and Allied Problems in Magnesium Alloy Castings. Jour. Inst. Metals, vol. 78, October 1950, pp. 147-168.

Describes a method by which the degree of stress relief resulting from any given annealing treatment may be assessed. The method is capable of general application to stress-relief annealing problems and has been used to establish suitable conditions of treatment for a number of magnesium and aluminum-base casting alloys. The problems associated with the heat-treatment of the following four Elektron casting alloys for purposes of stress removal are discussed in detail: (1) The magnesium-aluminum alloy AZ91; (2) the magnesium-aluminum alloy A8; (3) the magnesium-zinc-zirconium alloy Z5Z; (4) the magnesium-rare-earth-zirconium alloy MOZ. It is shown that with (3) the relief of casting stresses and the precipitation-hardening of the alloy can be carried out simultaneously in a single heat-treatment. The problem of the magnesium-rare-earth zirconium alloy is of special interest, as annealing at the temperature customarily used for removing casting stresses is detrimental to the creep-resisting qualities of the alloy, which are its principal attraction.

See also abs. 639.

680. PEARSALL, C. S. New Brazing Method for Joining Nonmetallic Materials to Metals. Materials and Methods, vol. 30, No. 1, July 1949, pp. 61-62.

A new one-step method is given for the brazing of ceramics, carbides, and other nonmetallics. This process assures a strong lasting bond between metals, ceramics, or carbides.

681. PEARSALL, C. S., AND ZINGESER, P. K. Metal to Nonmetallic Brazing, Technical Report 104. Massachusetts Inst. Technol., Apr. 5, 1949, 20 pp. NP-841.

A series of experiments has been carried out on the direct brazing of metals and nonmetallic materials by a new, simple technique using brazing alloys of active metals, such as zirconium, titanium, tantalum, and columbium. Such materials as diamond, sapphire, carbides, various ceramics, refractory oxides, glass, quartz, stainless steel, etc. have been successfully brazed to like materials or to metals.

682. PEARSON, W. B. Vanadium and Its Alloys. Jour. Iron and Steel Inst., vol. 164, No. 2, February 1950, pp. 149-159.

The chemical and physical properties of vanadium metal, particularly in relation to the use of controlled atmospheres and refractory materials for containing the metal at high temperatures. Vanadium has a body-centered cubic structure, and the determinations of the lattice constant are briefly reviewed. Describes four methods of preparing the metal: (1) The alumino-thermic method; (2) the calcium reduction of the pentoxide; (3) the thermal decomposition of the di-iodide; and (4) the hydrogen reduction of the chlorides. Malleable vanadium can be obtained by the last three methods. An account of vanadium alloy systems is given under three main headings: (1) Alloys of vanadium with oxygen, nitrogen, carbon, and hydrogen; (2) the ferro-vanadium alloys; and (3) alloys of vanadium with various other elements. Attention is drawn to some of the experimental methods that will be required for the establishment of equilibrium diagrams of pure alloys of vanadium.

683. PECHMAN, A. Ceramics for High Temperatures. Chem. Eng., vol. 60, No. 11, November 1953, pp. 186-190; Ceram. Age, vol. 62, No. 5, November 1953, pp. 27-31, 34.

A brief survey of the field with emphasis on the newly developed ceramic coatings and cermets, which lend themselves to a number of applications in the chemical process industries.

Generated on 2024-09-20 18:03 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

PEKOLA, J. S. See abs. 236.

684. PENNSYLVANIA STATE COLLEGE. Quarterly Progress Report on the Investigation of Refractory Materials. Feb. 1, 1947, 9 pp. NP-120.

A report is given of the general progress that has been made in preparing new refractory materials and in the investigation of physical properties of refractory materials. Also discussed are the results of some preliminary observations on the relation between the thermal expansions of certain ceramic materials and their crystal structures.

685. _____. Report on the Physical Properties of Beryl and Zirconium Phosphate Bodies. November 1946, 4 pp. M-3340.

Bodies made from chemically pure tin oxide can withstand heat shocks in the interval 1,500° F. to room temperature. A body made from 70 percent chemically pure tin oxide and 30 percent natural beryl, and fired at 2,200° F., can withstand heat shocks from 1,500° F. to room temperature. Bodies composed of 100 percent milled zircon, and sintered at 2,660° F. and 2,730° F. can withstand heat shocks from 1,500° F. and 2,000° F. to room temperature. When thorium chromate and cerium chromate are heated, the compounds decompose into constituent oxides.

686. _____. Summary Report No. 1 of the Research for Government Contract No. W33-038 ac 13506, for Period January 1, 1946 to October 31, 1946. Dec. 24, 1946, 32 pp. NP-1260.

It was originally proposed that the work done should be of a fundamental nature, involving the preparation of new ceramic phases and the measurement of pertinent properties of both ceramic compounds and refractory carbides and nitrides. The measurements of refractoriness and thermal expansion have been used as primary criteria of promising ceramic oxides or compounds while X-ray and microscopic investigations have supplemented these data. Other secondary tests that have been developed involve the measurement of mechanical strength and resistance to thermal shock.

687. PEPKOWITZ, L. P., AND CHEBINIAK, P. Precision Determination of Carbon in Metals by a High Frequency Combustion-Volumetric Method. Knolls Atomic Power Lab., KAPL-637. Sept. 12, 1951, 12 pp.

A precision method for determining carbon in metals is presented utilizing a high frequency combustion-volumetric procedure. A mean deviation of ± 0.005 percent was attained on a 1 gram sample with a lower limit of precise measurement of 0.02 percent C. A mean error of ± 0.004 percent was obtained with National Bureau of Standards standard steels. The method has been applied to a variety of metals such as Bessemer steels, stainless steels, titanium, vanadium, and zirconium. The time for an analysis, not including the weighing interval, is 2 to 3 minutes.

PERKINS, F. C. See abs. 748.

PERLMAN, I. See abs. 296.

688. PERRYMAN, E. C. Stress-Corrosion of Magnesium Alloys. Jour. Inst. Metals, vol. 18, No. 6, February 1951, pp. 621-642.

The stress-corrosion properties of magnesium-5 percent aluminum alloy in distilled water and other solutions have been investigated. Stress corrosion tests were also carried out on other commercial magnesium-base alloys and on high-purity magnesium. Rapid transcrystalline cracking of stressed magnesium-5 percent aluminum alloy in distilled water took place whether the alloy contained a precipitated second phase or not. This cracking bore no apparent relationship to the metallographic structure, following neither grain boundaries nor twin planes. Stress-corrosion was associated with a localized penetrative type of transcrystalline attack, which was never observed to be more than 2-3 grains deep. The

Generated on 2024-09-20 18:03 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

stress-corrosion resistance decreased with increase in iron content and in amount of plastic deformation, but was improved by annealing at 200° C. after plastic deformation. The presence of dissolved oxygen was found essential for stress-corrosion to operate, for example, stressed loop specimens which failed in aerated distilled water in 10 days did not crack in deaerated water in 60 days. Transcrystalline stress-corrosion fractures occurred in saturated magnesium carbonate, 0.05 percent potassium fluoride, and 0.5 percent potassium hydrogen fluoride solutions and in 0.5 percent hydrofluoric acid and intercrystalline fractures in 0.05 percent potassium chromate solution. The susceptibility to stress-corrosion failure of the various commercial alloys tested was consistent with their reported service behavior, the magnesium-manganese and magnesium-zinc-zirconium alloys being more resistant than the magnesium-aluminum alloys. All the alloys tested and also high-purity magnesium suffered stress-corrosion cracking in 0.5 percent potassium hydrogen fluoride solution. No detailed mechanism of stress-corrosion cracking in magnesium-base alloys is put forward, though the results show that the process is, in part, electrochemical. It is thought that cracking may be associated with minor impurities, for example, iron, which are known to have a deleterious effect on the ordinary corrosion-resistance.

PETERS, W. C. See abs. 526.

689. PETERSON, M. B., AND JOHNSON, R. L. Friction and Surface Damage of Several Corrosion-Resistant Materials. Nat. Advisory Comm. Aeronau., Lewis Flight Propulsion Lab., NACA RM E51L20, Feb. 20, 1952, 20 pp.

An investigation, in air, of the friction and surface damage of several materials that are resistant to corrosion by liquid metals was made. The values of kinetic friction coefficient at low sliding velocities and photomicrographs of surface damage were obtained. Appreciable surface damage was evident for all materials tested except tungsten carbide. The friction coefficients for the combinations of steel, stainless steel, and Monel sliding against steel, stainless steel, nickel, Inconel and Nichrome ranged from 0.55 for the Monel-Inconel combination to 0.97 for the stainless-steel-nickel combination; for steel, stainless steel, Monel and tungsten carbide against zirconium the friction coefficients were approximately 0.47. Lower coefficients of friction (0.20 to 0.60) and negligible surface failure at light loads were obtained with tungsten carbide when used in combination with various plate materials.

PETRETIC, G. J. See abs. 43.

690. PFEIL, P. C. Critical Review of the Alloying Behavior of Zirconium. Atomic Energy Research Est., AERE M/TN 11, England, June 9, 1952, 22 pp.

To assist in the discussion of the factors underlying the alloying behaviour of zirconium presented in AERE Report M/R 960, a critical review has been made of the literature on zirconium alloy system. Data on the mechanical properties of the alloys has been included.

691. _____. Discussion of the Factors Affecting the Constitution of Zirconium Alloys. Atomic Energy Research Est., AERE M/R 960, England, June, 1952, 35 pp.

Owing to the importance of zirconium alloys, an attempt is made to extend existing alloy theory to zirconium. A forecast is made of the elements that may dissolve in the metal, and attention is given to the probable influence on the allotropic transition. Discussion of the observed alloying behavior of zirconium (AERE M/TN 11) and of the behavior of similar titanium alloys indicates that there is more than one factor operative in determining the effects of solute elements on the relative stabilities of the allotropes. A program of experimental work to find out more

Generated on 2024-09-20 18:54 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

about the factors governing the alloying behavior of zirconium is suggested. The alloy systems with silver, aluminum, columbium (niobium), and molybdenum appear to be of particular theoretical importance, whereas further information is required about zirconium-titanium alloys.

692. PIETROKOWSKY, P. Cursory Investigation of Intermediate Phases in the Systems Ti-Zn, Ti-Hg, Zr-Zn, Zr-Cd, and Zr-Hg by X-ray Powder Diffraction Methods. Jour. Metals, vol. 6, No. 2, February 1954, pp. 219-226.

Intermediate phases in the binary metal alloy systems Ti-Zn, Ti-Hg, Zr-Zn, Zr-Cd, and Zr-Hg have been investigated by X-ray powder diffraction methods. Gamma-Ti_3Hg and Zr_3Hg have a beta tungsten structure; TiHg and ZrHg are analogous to ordered AuCu(L 1_o type); delta-Ti_3Hg and $ZrHg_3$ are isomorphous with ordered $AuCu_3$ (L 1_2 type); $ZrZn_2$ is face-centered cubic (C 15 type); $TiZn_2$ crystallizes in a C 14 type structure, and $Zr_{(1-x)}$ $Cd_{(x)}$ occurs in cubic and tetragonal modifications in which a random distribution of atoms exist. Additional information for the intermediate phase $TiZn_3$ is presented.

PITTMAN, F. K. See abs. 788.

PLEDGER, F. See abs. 180.

693. PLOTNIKOV, V. A., AND GITMAN, E. B. Electrolytic Separation of Zirconium. Jour. Appl. Chem. (U. S. S. R.), vol. 19, No. 8, 1946, 5 pp. NP-2232.

Since work with an aqueous solution is easiest, the investigation of electrolytic separation of zirconium started with a repetition of the electrolysis of aqueous zirconium sulfate according to Linford. Under the conditions described by Linford, only a black turbidity at the cathode together with a profuse evolution of hydrogen was obtained. Neither a brilliant deposit nor zirconium powder could be obtained by this method. This checks with the results reported by GIPKh (State Institute of Applied Chemistry) workers. Subsequently, experimentation was carried out with melts, investigating the effects of temperature and current density at the cathode on the quality of the zirconium deposit separated electrolytically from the following mixtures: $AlCl_3$-KCl - NaF - ZrO_2; 2KF-ZrF_4; KCl - NaCl - K_2ZrF_6; NCl - NaCl - NaF - ZrO_2; $ZrCl_4$ - NaCl.

694. PLOTNIKOV, V. O., AND KIRICHENKO, O. I. /Electrolytic Deposition of Zirconium From its Fused Salts./ Memoirs of Inst. Chem., Ukrainan S. S. R., vol. 6, No. 1, 1939, pp. 3-17.

The electrolytic isolation of zirconium is investigated in a fused mixture of salts, $AlCl_2$-KCl-NaF-ZrO_2. Electrolysis was conducted in a porcelain beaker with a graphite or aluminum anode and a copper cathode at a temperature ranging from 500° - 550° C.

PLUCKNETT, W. K. See abs. 772.

POELLMITZ, G. S. See abs. 966.

695. POLE, G. R., BEINLICH, A. W., JR., AND GILBERT, N. Physical Properties of Some High-Temperature Refractory Compositions. Jour. Am. Ceram. Soc., vol. 29, No. 8, 1946, pp. 208-222.

In the course of an investigation that involved a study of pyrochemical reactions, it was necessary to develop a refractory that could be used satisfactorily at temperatures in the range of 1,800° to 2,200° C. It was found that calcined magnesia (06 percent MgO) or electrically fused magnesia (98 percent MgO) could be bonded adequately by mixing sized aggregates with 2.5 percent by weight of calcined sea-water magnesia and wetting with a 24° Be. solution of magnesium chloride. Large shapes of these compositions fired at 1,450° C. were satisfactory for use in the required temperature range. A small-scale study of the properties of various refractory bodies showed that compositions containing relatively pure

Generated on 2024-09-20 18:11 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

limestone or dolomite readily hydrated in water even after firing to 2,100° C. and were unsuitable for refractory use. The addition of silica, alumina, zirconia, chromic oxide, or combinations of these oxides to dolomite or limestone resulted in a refractory stable against hydration. The inversion of zirconia was reduced appreciably by adding 5 percent magnesia. Bodies containing $BaO.ZrO_2$ and $CaO.ZrO_2$ were found to be stable after firing to 2,100° C. with no inversion up to 1,200° C. and with a coefficient of expansion less than that of electrically fused magnesia. Small- and large-scale tests of an $MgO.Cr_2O_3$ spinel composition showed this material to be highly refractory with a low coefficient of expansion; the compound, however, dissociates and loses Cr_2O_3 above 1,700° C. Although the small-scale tests disclosed a number of compositions that show promise as high-temperature refractories, their full evaluation for use on a large scale was not made.

696. POLLARD, F. H., AND McOMIE, J. F. Chromatographic Methods of Inorganic Analysis With Special Reference to Paper Chromatography. Academic Press, Inc., New York, N. Y., 1953, 192 pp.

Presented in this report are the theories of chromatography. Quantitative and qualitative analysis procedures are given in detail for the separation of inorganic compounds. Special emphasis is placed on paper chromatography.

697. POLLING, J. J., AND CHARLESBY, A. Analysis of Formation Current in Electrolytic Oxidation of Zirconium. Atomic Energy Research Est., AERE M/R 1176, England, 1953, 13 pp.

Thin oxide layers may be formed on certain metals such as aluminum, tantalum, and zirconium by oxidizing them anodically in suitable electrolytes. The films formed are insulating and quite different in character from the usual porous films formed, for example, an aluminum in an electrolyte of aqueous sulfuric or oxalic acid. Over a wide range, the film thickness (δ) is proportional to the voltage (V_f) at which the film is formed at room temperature and varies but slightly with the formation current (i). This indicates that the average electric field (E_f) across the film is approximately constant during formation. The problem is best studied for a metal in which the two forms of current are comparable in amount. Zirconium was chosen since it is believed that for this metal the current efficiency is usually about 50 percent. The bulk oxide is known to contain considerable and variable amounts of water. The methods used in this paper provide a method of studying the degree of hydration of these thin films of oxide and their dissolution in electrolytes. In the first part of the paper, the electron current is deduced from the oxygen liberated. By subtracting this electron current from the total current, the presumed ion current is obtained. The film growth corresponding to this ion current can then be calculated directly. In the second part of the paper, the ion current is deduced directly from the weight increase of the oxide layer.

PONS, J. T. See abs. 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276.

POOL, M. L. See abs. 189, 632.

698. PORTCASTLE, T. O. Analysis of Zirconium, Part I: Detection Separation and Estimation of Hafnium Content. Chem. Age (London), vol. 68, Mar. 7, 1953, pp. 389-392.

Covers the uses of zirconium metal and its alloys. The separation method for zirconium and hafnium is compared to other similar methods.

699. _____. Analysis of Zirconium, Part II: Quantitative. Chem. Age (London), vol. 68, Apr. 4, 1953, pp. 533-536.

Several methods are given for the quantitative analysis of zirconium. Comparisons have been made between the various methods.

Generated on 2024-09-20 18:08 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

700. PORTCASTLE, T. O. Analysis of Zirconium, Part III: Organic Reagents. Chem. Age (London), vol. 68, May 1, 1953, pp. 673-677.

Several methods utilizing organic reagents are given for the analysis of zirconium.

701. _____. Analysis of Zirconium, Part IV: Miscellaneous Methods. Chem. Age (London), vol. 68, May 16, 1953, pp. 741-744.

Several methods are given for analyzing of zirconium.

702. POST, V., AND GLASER, F. W. Crystal Structure of ZrB_{12}. Jour. Metals, vol. 4, No. 6, June 1952, pp. 631-632.

Although most transition metals form a wide variety of boride compounds, the existence of only one zirconium boride, ZrB_2, had been established before this investigation. The crystal structure and some properties of a hitherto unreported zirconium boride, ZrB_{12}, are described in this paper. Only one other dodecarboride of a transition metal, UB_{12}, has been reported up to the present.

703. POTTER, H. H. Electrical Resistance and Thermoelectric Power of the Transition Metals. Proc. Phys. Soc. (London), 1941, pp. 695-705.

The electrical resistances and thermoelectric powers of the transition metals and their variations with temperature have been measured. The relation of the results to the theory of Mott and Jones is discussed.

704. POTVIN, R., AND FARNHAM, G. S. Producing Zirconium and Titanium in Germany. Trans. Canadian Inst. Min. and Met., vol. 49, 1946, pp. 516-524.

The demand for pure zirconium and titanium metals in Germany increased considerably during the war. Pure zirconium was used in flash bulbs, in vacuum tubes, and in time fuses for bombs, where it has a decided advantage because it gives no gas in burning. Under the form of alloy, it was used with other rare elements for making substitutes for platinum; it was also used as a scavenging agent in high-grade steels. Metallic titanium was mainly used in connection with the manufacturing of special alloys. The authors were sent to Germany by the Department of Reconstruction and have investigated the German process developed for producing these rare metals. They describe the procedure and special equipment used for their commercial production in Germany during the war.

POWELL, J. E. See abs. 848.

PRAKASH, S. See abs. 177.

705. PRASAD, M., AND MODAK, K. V. Measurement of Opacity During the Coagulation of the Concentrated Sols of Zirconium and Stannic Hydroxides and the Gelation of Stannic Phosphate and Zirconium Hydroxide Gel-Forming Mixtures. Proc. Indian Acad. Sci., 12A, 1940, pp. 235-244.

A discussion of experimental methods, equipment, and results in the phenomena of coagulation. A comparison is made with the process of gelation. Optical results fail to show any distinct differences between the processes of coagulation and gelation.

PRATT, H. R. See abs. 242.

706. PRESCOTT, C. H., JR. Equilibrium Between Zirconium Oxide and Carbon and Their Reaction Products at Incandescent Temperatures. Jour. Am. Chem. Soc., vol. 48, 1926, pp. 2534-2550.

An apparatus and technique have been developed suitable for the study of equilibria between oxides and carbon at temperatures from 1,000° to 2,200° K. and at equilibrium pressures from a few centimeters to 3 atmospheres. Temperatures were measured with an optical

Generated on 2024-09-20 18:08 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

pyrometer. The furnace was a graphite tube 0.318 cm. in diameter with a 0.04 cm. wall supported on tungsten rods and enclosed in Pyrex glass. The pressures were read on mercury manometer. The enclosed gas space was about 100 cc. and was all below the water level of a thermostat at 35°. Experiments were made on compressed pellets of zirconium oxide and graphite weighing approximately 90 mg. The procedure was to determine at a series of temperatures and pressures the rate of change of pressure with the time. From a series of such experiments at a single temperature and different pressures the equilibrium pressure was estimated. The composition of the solid phases was determined from X-ray powder photographs. These showed the reaction to be $ZrO_2 + 3C = ZrC + 2CO$. The increases in free energy and heat content that would attend this reaction between 1,880° and 2,015° K. at 1 atmosphere were found to be those given by the equations $\Delta F° = 151,800 - 78.68T$, and $\Delta H = 151,800$ calories. At 1,930° K. the free-energy change becomes zero, and the actual equilibrium pressure is 1 atmosphere.

707. PRESSLY, R. S., AND RUPP, A. F. Purification of Fission-Product Rare Earths by Ion Exchange. Oak Ridge Nat. Lab., ORNL-1313, Apr. 20, 1953, 29 pp.

This report presents the procedures used at Oak Ridge National Laboratory for the separating and purifying the fission-product rare earths pure enough to meet the specifications of the radioisotope distribution program. The separations, involving curie levels of activity, are made on heated and unheated resin columns. The products are removed by elution, using complexing agents at various pH levels. No isotope carrier is added.

PRESTON, R. S. See abs. 179.

PRICE, R. J. See abs. 142, 143.

708. PROD. ENG. More Zirconium. Vol. 24, No. 12, December 1953, p. 9.

A news item on production of zirconium by Carborundum Metals Co., Inc., Akron, N. Y.

PROTHEROE, H. T. See abs. 46.

PUGH, J. W. Development of Zirconium Base Alloys. See abs. 385.

_____. Development of Zirconium Base Alloys. See abs. 386.

709. PURUSHOTTAM, A., AND RAO, S. V. Phthalic Acid as a Selective Reagent for Zirconium. Analyst, vol. 75, December 1950, pp. 684-686.

Pthalic acid precipitates zirconium quantitatively from solutions 0.35 N with respect to free hydrochloric acid. From solutions 0.3 N in hydrochloric acid, most elements, such as thorium, iron, aluminum, beryllium, uranium, manganese, nickel, and ceria earths, can be separated in a single precipitation, but tin, titanium, vanadium, and chromium require a second precipitation. The reagent is thus selective for zirconium.

710. QUENNSLAND GOVERNMENT MINING JOURNAL. Mining in Queensland, Report of the Under Secretary for Mines. Vol. 54, No. 621, July 20, 1953, pp. 441, 443, 445, 446.

Mineral production figures are given for Queensland, Australia, for 1952.

QUILL, L. L. See abs. 521.

RAEUCHLE, R. F. See abs. 753.

RAINWATER, L. J. See abs. 362.

711. RALL, W. Exact Masses of the Zirconium Isotopes. Argonne Nat. Lab., June 24, 1946, 2 pp. MDDC-1311. Decl. Sept. 10, 1947.

The packing fraction of the zirconium isotopes has been found by comparison with uranium 238. The difference is $(12.1 \pm 0.9) \times 10^{-4}$. Using the published value for uranium of 5.6×10^{-4}, the zirconium packing fraction comes to be -6.5×10^{-4}.

Generated on 2024-09-20 18:06 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

RALSTON, O. C. See abs. 229.

712. RAO, B. R. Refractory Raw Materials in Southern India. Jour. Geol. Min. Met. Soc. (India), vol. 18, No. 4, 1946, pp. 85-95.

An account is given of the deposits of refractory minerals of Southern India.

RAO, S. V. R. See abs. 709, 919, 920.

RAY, W. E. See abs. 719, 720, 721.

RAYNES, B. C. See abs. 818.

713. RAYNES, B. C., THELLMANN, E. L., STEINBERG, M. A., AND WAINER, E. Extractive Metallurgy of Titanium by the Electrolysis of Fused Salts III. Expanded Scale Process Development of the Electrolytic Production of Zirconium from K_2ZrF_6. Jour. Electrochem. Soc., vol. 102, No. 3, March 1955, pp. 137-144.

The electrolysis of K_2ZrF_6 in an electrolyte of NaCl to produce ductile zirconium metal has been expanded from the laboratory scale into a larger scale operation. An electrolytic cell capable of producing 3-4 lb. of zirconium metal per run was designed and operated. Following successful operation of this unit, a cell capable of producing 30-40 lb. of zirconium metal per run was used to evaluate the process on a scale 50 to 60 times the laboratory scale. Electrolytic zirconium powder of high purity has been reproducibly obtained in good yields and at commercially acceptable current efficiencies. Upon consolidation, the metal shows fabricating properties comparable to those exhibited by Kroll sponge zirconium. The present larger electrolytic cell produces zirconium metal at a rate approaching that of the original commercial Kroll sponge producing reactors. Further expansion to larger scale operation should be entirely feasible.

RAYNES, B. C., WAGNER, F. C., AND STEINBERG, M. A. Production of Zirconium by Fused Salt Electrolysis, Technical Progress Report, Sixth Quarter. See abs. 817.

714. RAYNOR, W. M. Zirconium, An Abundant Rare Metal. Foote Prints, vol. 15, No. 2, 1943, pp. 3-10.

This is a general coverage of the properties, uses, metallurgy, chemistry of zirconium. Developmental work by the Foote organization has resulted in the production of this ductile metal in modest quantities. Development of large-scale production methods will result in a cheaper product, which in turn will make this metal available for many potential applications.

715. _____. Zirconium and Its Applications. Min. and Met., vol. 28, No. 486, June 1947, pp. 284-285.

Zirconium possesses many characteristics that would make its general use of great benefit. This bright, tarnish-proof metal is more abundantly distributed in the earth's crust than is copper or lead. Zirconium will remain a scarcity until an idea brings its widespread application within the economic grasp of man. High production costs deter general use of this adaptable element, although further process experimentation promises to alter this in the future.

716. REA, R. F. Cone Fusion Study of Mixtures of Zirconium Silicate, Silica and Alumina. Jour. Am. Ceram. Soc., vol. 22, 1939, pp. 95-96.

Alumina and alumina-silica mixtures have a strong fluxing effect on zirconium silicate. A eutectic between $ZrSiO_3$ and Al_2O_3 occurs at approximately 20 percent Al_2O_3 and melts at cone 31. The ternary eutectic has an approximate composition of 70 percent SiO_2, 15 percent $ZrSiO_3$, 15 percent Al_2O_3, and PCE of cone 27. In this paper, the results of PCE determinations on mixtures of $ZrSiO_3$, Al_2O_3, and SiO_2 are given. Small test cones were made of various mixtures of

Generated on 2024-09-20 18:01 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

C.P. zirconium silicate, C. P. aluminum oxide, and 200-mesh Ottawa silica, which had been purified by washing in hot hydrochloric acid. The zirconium silicate analyzed 99.5 percent $ZrSiO_3$ and was ground to pass a 325-mesh screen.

717. READ, E. B., AND ZOPATTI, L. P. Determination of Oxygen in Zirconium Metal. Massachusetts Inst. Technol., Feb. 14, 1950, 7 pp. AECD-2798.

This paper is a discussion of the problems involved in determining, with reasonable accuracy, the oxygen content of zirconium metal and describes a chemical method that yields accurate values, as shown by recovery of oxygen additions to the metal.

718. READ, H. J. Corrosion of Zirconium, First Quarterly Report. Pennsylvania State College, Dec. 31, 1950, 7 pp. NYO-835.

This report gives background information on the corrosion of zirconium. Plans for the initial experimental work on the project are outlined. They involve a study of the formation of corrosion products on thin films of zirconium. This approach will permit the use of transmission methods for the study of the corrosion products by electron diffraction and electron microscopy.

719. COLTERYAHN, L. E., RAY, W. E., AND READ, H. J. Corrosion of Zirconium. Pennsylvania State College, Sept. 30, 1951, 14 pp. NYO-836.

Thin films of zirconium that are to be used in corrosion studies have been prepared by cathodic sputtering. Dense, continuous films were obtained in 10 hours at a cathode current density of 0.014 milliamperes per square millimeter in an atmosphere of krypton at 140 to 180 microns pressure. Modifications in the sputtering apparatus have been made as the result of operating experience and the present apparatus is quite satisfactory with respect to leakage rates and ease of manipulation. Furnaces have been constructed for contamination of pure films with gaseous impurities and for the corrosion of specimens in gaseous corrosive atmospheres.

720. COLTERYAHN, L. E., JOSEPH, W., RAY, W. E., AND READ, H. J. Corrosion of Zirconium. Pennsylvania State College, Dec. 31, 1951, 16 pp. NYO-837.

Thin films of zirconium satisfactory for corrosion studies have been obtained by cathodic sputtering onto electropolished copper foil. The conditions that had been previously reported as yielding continuous films remain unchanged. A preliminary X-ray study indicated that some difference in crystal structure results when zirconium oxide is prepared from the hydroxide that has been precipitated from an aqueous solution with sodium hydroxide or ammonium hydroxide and subsequently ignited. The rate of oxidation of zirconium at elevated temperatures has been found to increase very rapidly in the presence of water vapor. Up to the present time, very little success has been attained in the preparation of magnesium single crystals that would be satisfactory as basis metal for the growth of single-crystal films of zirconium by epitaxy.

721. _____. Corrosion of Zirconium. Pennsylvania State College, Mar. 31, 1952, 16 pp. NYO-838.

The preparation of thin zirconium films is well in hand. Extensive effort, however, has been given to the problem of surface structure of the copper basis metal, and it was found that the sequence of buffing followed by electropolishing will yield a copper surface that is free of confusing details. The results of an electron diffraction study, both by transmission and reflection techniques, on massive metal, on thin films of zirconium, and on black and white oxide films have not been encouraging. No future work is being planned along this line. X-ray data so far obtained from black and white oxides are still not conclusive with regard to any differences between the two oxides. It has been possible to identify ammonia in the gases evolved when nitrogen-contaminated zirconium is corroded in water vapor. The presence

Generated on 2024-09-20 18:05 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

of ammonia in the effluent vapors suggests that the role of defect structures may be important in the oxidation and corrosion of zirconium. Preliminary experiments to confirm or deny this speculation have been planned and will be carried out as soon as suitable apparatus has been secured.

REAS, W. H. See abs. 127.

722. REDMOND, R. F., AND LONES, J. Enthalpies and Heat Capacities of Stainless Steel (316), Zirconium, and Lithium at Elevated Temperatures. Carbide and Carbon Chem. Corp., Oak Ridge, ORNL-1342, Dec. 30, 1952, 24 pp.

The purpose of this investigation was the determination of the heat capacities of zirconium and lithium at elevated temperatures. In making these measurements, secondary information on the heat capacity of stainless steel and the relative enthalpies of the three materials at elevated temperatures were also obtained. The zirconium data extend the temperature range for which zirconium heat capacities have been reported. The lithium data have been obtained in an effort to appraise the widely differing results previously reported by other investigators.

REED, A. C. See abs. 754.

723. REED, R. D., AND WITHROW, J. R. Zirconium, II, Detection of Potassium by Zirconium Sulfate in the Presence of Ammonium Ions. Jour. Am. Chem. Soc., vol. 50, November 1928, pp. 2985-2987.

The sensitiveness of zirconium sulfate for potassium in the presence of ammonium ions was found to be 0.48 mg. or more of potassium per 2 cc. of reaction mixture. This is virtually the same sensitiveness of zirconium sulfate for potassium when no other metal ions were present. This detection in the presence of ammonium is a distinct advantage over the other tests for potassium.

724. _____. Zirconium, III, Influence of Lithium, Rubidium, Cesium, and Magnesium Upon the Detection of Potassium by Zirconium Sulfate. Jour. Am. Chem. Soc., vol. 51, April 1929, pp. 1062-1065.

Zirconium sulfate will detect 1.0 mg. or more of potassium in 2 cc. of reaction mixture in the presence of lithium, rubidium, cesium, or magnesium ions, as well as those of sodium and ammonium. Potassium is detected by zirconium sulfate without the use of alcohol or complicated procedure. It should always be used as the preliminary reagent, therefore, in looking for potassium, before going through the ordinary more complicated procedure.

725. _____. Zirconium, IV, Precipitation of Zirconium by Phosphates. Jour. Am. Chem. Soc., vol. 51, May 1929, pp. 1311-1315.

The efficiency of sodium phosphate, phosphoric acid, ammonium phosphate, and microcosmic salt as precipitants for zirconium has been investigated, and the last three were found to be equally efficient and more efficient than sodium phosphate. Even sodium phosphate removed virtually all of the zirconium. The phosphates were found most efficient in the presence of 0.344 to 0.668 N sulfuric acid and less efficient in the presence of 0.269 N nitric acid or 0.204 N hydrochloric acid. Although record was found in the literature of the formation of basic zirconium phosphate in the absence of added acid, no record was found indicating incompleteness of precipitation of zirconium under these conditions. Investigation showed that phosphates are not efficient in removing zirconium in the absence of added acid.

726. _____. Zirconium, V, Detection of Traces of Potassium in the Presence of Zirconium. Jour. Am. Chem. Soc., vol. 51, November 1929, pp. 3238-3241.

The use of phosphates to remove zirconium before testing for potassium by

Generated on 2024-09-20 18:11 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

sodium cobaltic nitrite is not advisable because of loss or dilution of potassium. When phosphoric acid is neutralized with sodium hydroxide and the solution tested with sodium cobaltic nitrite, a misleading precipitate is secured unless a considerable excess of acetic acid is added. Zirconium can be removed by ammonium hydroxide and potassium detected in the filtrate by sodium cobaltic nitrites after eliminating the ammonium. The best and shortest way of eliminating zirconium before testing for potassium by sodium cobaltic nitrite is by throwing the zirconium into a complex ion with tartaric acid and controlling the acidity with sodium hydroxide and acetic acid.

727. REED, R. D., AND WITHROW, J. R. Zirconium VI, Use of Dispersoids in the Detection of Traces of Potassium by Zirconium Sulfate. Jour. Am. Chem. Soc., vol. 52, 1930, pp. 2666-2668.

'Seeding' by adding a salute dispersoid furnishes suitable nuclei for initiation of visible precipitation without introducing appreciable quantities of the material to be detected. The addition of a drop of a dispersoid of the desired product hastens the detection of potassium by zirconium sulfate. The sensitivity of zirconium sulfate reagent for potassium was increased through the presence of the dispersoid from 0.48 mg. of potassium to 0.32 mg. per 2 cc. of reaction mixture. The zirconium sulfate reagent did not completely remove potassium from solution.

728. REINHART, F. M. Corrosion of Magnesium Alloy Zk60A in Marine Atmosphere and Tidewater. Nat. Advisory Comm. Aeronau., NACA TN 2632, February 1952, 10 pp.

The corrosion resistance of unprotected magnesium-zinc-zirconium alloy Zk60A was determined in a marine atmosphere and in tidewater. The unprotected alloy was so rapidly attacked in tidewater that it would be of no practical value in applications subject to wetting by sea water. In the marine atmosphere, the rate of corrosion was much less and the alloy should give good service if adequately protected.

See also abs. 163.

RENSE, W. A. See abs. 678.

RENTSCHLER, H. C. See abs. 540.

729. RENTSCHLER, H. C., AND HENRY, D. E. Action of Oxygen, Nitrogen, and Hydrogen in Lowering the Photoelectric Work Function of Zirconium, Titanium, and Thorium. Phys. Rev., vol. 63, January-June 1943, p. 217.

An abstract of an article on the action of oxygen, nitrogen, and hydrogen in lowering the photoelectric work function of zirconium, titanium, and thorium, on work done by Westinghouse Lamp Division.

730. _____. Lowering of the Photoelectric Work Function of Zirconium, Titanium, Thorium, and Similar Metals by Dissolved Gases. Trans. Electrochem. Soc., vol. 87, 1945, pp. 289-298.

It is well known that the photoelectric threshold of certain metals such as cesium, barium, thorium, etc., is shifted toward the longer wave length when the metal reacts with oxygen. This is generally attributed to the formation of a monomolecular layer of the active element on another metal or on an oxide. This paper describes experiments that show a similar photoelectric threshold shift due to the interaction of oxygen, nitrogen or hydrogen with zirconium, titanium, etc. The results indicate that the lowering of the photoelectric work function is caused by the formation of a solid solution of the gas in the metal.

REYNOLDS, D. H. See abs. 119.

731. REYNOLDS, J. H Isotopic Constitution of Silicon, Germanium, and Hafnium. Phys. Rev., vol. 90, No. 6, June 15, 1953, pp. 1047-1049.

Generated on 2024-09-20 18:08 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The isotopic constitutions of silicon, germanium, and hafnium have been measured with a mass spectrometer by techniques that are described. Results for silicon are in good agreement with certain of the earlier determinations but are in poor agreement with the values adopted in the recent compilation by Bainbridge and Nier. Results for germanium do not differ significantly from earlier determinations. Results for hafnium differ only slightly from the one previous determination in which electrical detection was used, but in such a way as to suggest that determinations on hafnium, which has been fractionally purified with respect to zirconium, may not be faithfully representative of the true abundances. An upper limit of 0.003 percent has been placed on the abundance in nature of Hf^{182}.

732. REYNOLDS, M. B. New Plastic Constants of Some Metals. Knolls Atomic Power Lab., May 1, 1951, 85 pp. AECD-3242.

Reviews the ultrasonic pulse technique for the measurement of the elastic constants of solids. The elastic constants of a number of less common metals have been measured and these are compared with literature values where these exist. The constants for columbium, titanium, thorium, and vanadium ar reported here for the first time.

REYNOLDS, N. B. See abs. 182.

RHODERICK, E. V. See abs. 265, 268, 269, 270, 271, 272, 273.

733. RICE, A. C., FOGG, G. C., AND JAMES, C. Phenylarsonic Acid as a Reagent for the Determination of Zirconium and Thorium. Jour. Am. Chem. Soc., vol. 48, April 1926, pp. 895-901.

Zirconium phenylarsonate is an extremely insoluble substance, suited for separating zirconium from all elements except hafnium. It has been shown that it can be quantitatively precipitated from both hydrochloric acid and sulfuric acid solutions. Thorium phenylarsonate differs from the phenylarsonates of the rare earths, being insoluble in solutions containing large amounts of acetic acid. Gives a method for determining thorium in monazite sand. The authors highly recommend this reagent for the quantitative determination of zirconium and thorium. Work is being continued with regard to the quantitative estimation of hafnium by this reagent.

RICH, M. N. See abs. 567.

734. RICHARDS, J. T. Beryllium and Beryllium Alloys. Jour. Metals, vol. 3, No. 5, May 1951, pp. 379-386.

A summary of data covering the processing and property data of beryllium and its alloys. Included among the various alloys is the beryllium-zirconium system.

RIEMAN, W. See abs. 82.

735. ROBERSON, A. H. Metallography of Zirconium and Zirconium Alloys. Metal Progress, vol. 56, No. 5, November 1949, pp. 667-669.

The continued interest and rapidly expanding production of zirconium has presented metallurgical laboratories with a new problem of devising satisfactory metallographic techniques and procedures for the study of this interesting metal and its alloys. There is marked similarity in the metallographic behavior of zirconium and titanium and the techniques and etchants described in this paper apply almost as well to titanium as to zirconium.

736. _____. Zirconium Atomic Power Metal. Min. World, vol. 15, No. 8, May 1953, pp. 40-45.

Production problems have been solved to the point where the metal has been reduced to $50 per pound of metal, making its use important in the atomic submarine engine.

Generated on 2024-09-20 18:54 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

See also abs. 365, 366, 368, 369, 370, 371, 372.

737. ROBERSON, A. H., HAYES, E. T., AND DONALDSON, V. V. Zirconium-Manganese Phase Diagram; chap. in Zirconium and Zirconium Alloys. Am. Soc. Metals, Cleveland, Ohio, 1953, pp. 283-291.

A constitutional diagram covering the zirconium-rich portion of the zirconium-manganese system has been developed. Alloy preparation was a major problem owing to the volatilization of manganese and extreme segregation. The general pattern of the diagram is similar to the Fe-Fe_3C system. Alpha solubility is negligible; beta solubility is 6.4 percent at 1,135° C. The beta phase decomposes eutectoidally at 3 percent manganese and 795° C. The eutectic composition is 22.5 percent manganese and the eutectic temperature is 1,135° C. The alloys containing as much as 22 percent manganese are amenable to hot working.

738. ROBERSON, A. H., AND STEPHENS, W. W. Zirconium - Once a Rare Metal, It is Now Ready for Commercial Use. Modern Metals, vol. 6, No. 8, September 1950, pp. 36-38.

Zirconium, one of the latest rare metals to be brought into production, possesses properties that make it of considerable interest for application in constructing reactors for harnessing atomic energy, for chemical plant equipment requiring superior corrosion resistance and for various surgical applications. Properties, processes, and uses are covered.

739. ROBERTS, L. D., SARTAIN, C. C., AND DABBS, J. W. T. Electrical Resistance of High-Purity Zirconium Below 300° K.; chap. in Physics Div. Quarterly Progress Rept. for Period Ending June 20, 1952. Atomic Energy Comm. Jan. 9, 1953, pp. 10-13. ORNL-1365.

Electrical resistance as a function of temperature has been measured for a high-purity zirconium sample from 14° to 300° K., and the Delbye θ has been calculated from the temperature-dependence of the resistance.

740. ROBERTS, R. M., AND GOOD, G. M. Effect of Nuclear Substitution on the Rate of Silica-Zirconia-Alumina-Catalyzed Depropylation of Cumene. Jour. Am. Chem. Soc., vol. 73, No. 3, March 1951, pp. 1320-1322.

A comparison was made of the relative ease of depropylation of cumene and several nuclear substituted cumenes in the presence of silica-zirconia-alumina cracking catalyst, by flow-method, fixed catalyst bed tests. At 450°, space rate 65 moles per liter catalyst per hour, the extents of depropylation were: 1,3-dimethyl-4-isopropylbenzene, 77 percent; p-cymene, 60 percent; 1,3-dimethyl-5-isopropylbenzene, 57 percent; cumene, 39 percent; p-chlorocumene, 25 percent; trichlorocumene (mixture of isomers), 8 percent. The methyl and chlorine substituents on the aromatic nucleus were not removed under the conditions of these tests. The same relative order of reactivity was observed in experiments at 400° with p-cymene, cumene, and p-chlorocumene. Relative rates predicated for electrophilic displacement of propyl by hydrogen calculated by an approximate molecular orbital method are in agreement with the observed results except in the case of 1,3-dimethyl-5-isopropylbenzene, for which the theory predicts a rate of depropylation equal to that of cumene. This correlation is taken as evidence that the dealkylation of alkylbenzenes in the presence of cracking catalysts of the silica-alumina type proceeds through formation of a polar intermediate complex between the alkylbenzene molecule and an acidic center on the catalyst.

741. ROBERTS, S. Dielectric Properties of Lead Zirconate and Barium-Lead Zirconate. Jour. Am. Ceram. Soc., vol. 33, No. 2, February 1950, pp. 63-66.

Describes methods for preparing lead zirconate and mixtures of lead and barium zirconate in ceramic form. These

Generated on 2024-09-20 18:08 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

compositions are shown to constitute a new class of ferroelectric materials having dielectric constants as high as 11,000. Dielectric constants are measured at 1 mc. per second in a temperature range 25° to 350° C. Nonlinear dielectric properties and piezoelectric effects are demonstrated.

742. ROBERTS, S. Piezoelectric Effect in Lead Zirconate. Phys. Rev., vol. 83, July 1951, p. 1078.

Ceramic disks of pure lead zirconate were polarized by applying an electric field while cooling from 250° to 100° C. One disk was polarized with a d.c. field of about 250v./mm., and a second disk was polarized with unidirectional pulses 800v./mm. in amplitude.

ROBERTSON, R. H. See abs. 372.

ROBINSON, R. M. See abs. 74.

743. ROCHLIN, R. S. Preparation of Tritium-Zirconium Targets. Rev. Sci. Instruments, vol. 23, No. 2, February 1952, pp. 100-101.

Methods have been described for preparing tritium targets for particle accelerators by absorbing gaseous tritium in thin foils of zirconium metal. This article gives details on this subject.

744. RODD, E. H. Properties and Constitution of Some New Basic Salts of Zirconium. Jour. Chem. Soc., vol. 111, 1917, pp. 396-407.

A basic sulfate of zirconium is prepared by partly neutralizing an impure dilute solution of zirconium sulfate in sulfuric acid with ammonia. From this basic sulfate a new basic chloride, 5:4 basic zirconium chloride, is prepared. It has the composition $Zr_5O_8Cl_4 22H_2O$. It is a crystalline salt, very readily soluble in water, and can be recrystallized unchanged from hydrochloric acid solution. Soluble sulfates precipitate from solutions of 5:4 basic zirconium chloride an insoluble sulfate, having the composition $Zr_5O_8(SO_4)_2, \chi H_2O$, where χ is probably 14. This is a noncrystalline compound, soluble in concentrated sulfuric acid. Corresponding with the 5:4 chloride and the 5:2 sulfate is a hydroxide prepared from either of these salts by the action of ammonia. It is distinct from normal zirconium hydroxide, since, when redissolved in hydrochloric acid it forms the 5:4 basic chloride. A basic sulfate is described, produced by adding sulfuric acid to a boiled solution of zirconium oxychloride, $ZrOCl_2$, $8H_2O$. This appears to have the same composition as the above 5:2 sulfate, although it is otherwise distinct therefrom. Constitutional formulas are suggested for the newly described salts and for other basic zirconium salts. The formation of the many complex basic salts of zirconium is attributed to hydrolysis of the simpler salts, followed by condensation in dilute solution and at high temperatures, occasioned by the weak basicity of zirconium hydroxide and its amphoteric character. The final product of these changes is metazirconic acid.

745. RODGERS, J. F., AND HARTER, G. J. Determination of Nitrogen in Zirconium by Micro-Kjeldahl Steam Distillation. Anal. Chem., vol. 26, No. 2, February 1954, pp. 395-396.

This is a rapid, accurate method for determining nitrogen in zirconium. A single determination may be made in a half hour or less, and as many as 160 may be made in an 8-hour day with 5 stills and 2 efficient operators. A comparison of results by vacuum fusion and Kjeldahl distillation methods showed the results by vacuum fusion to be consistently low, probably because some of the nitrogen is held by the zirconium in the molten state.

ROEBUCK, A. H. See abs. 74.

746. ROGERS, A. N. Use of Zirconium in the Vacuum Tube. Trans. Electrochem. Soc., vol. 88, October 1945, pp. 207-213.

Generated on 2024-09-20 18:52 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Problems are considered that are encountered during the use of zirconium metal and zirconium hydride powders in the manufacture of vacuum tubes. Describes the relative merits of binders and of various technics of coating tube elements with the finely divided metal or hydride. The problem of zirconium powder waste disposal is considered. Particular emphasis is placed on the handling of the two powders and the manufacturing hazards involved. Precautionary measures are outlined.

ROMANS, P. A. See abs. 635.

747. ROSE, K. New Magnesium Alloys Offer Superior Properties. Materials and Methods, vol. 28, No. 1, July 1948, pp. 66-69.

Discussion of a high strength magnesium extrusion alloy containing zirconium and of an alloy containing cerium.

748. ROSI, F. D., AND PERKINS, F. C. Mechanical Properties of Zirconium. Sylvania Elec. Prod., Inc., SEP-87, Dec. 9, 1952, 23 pp.

A study was made of the tensile properties of arc-melted Bureau of Mines Grade 'A' zirconium sponge in the temperature range -196° to 600° C. at a constant strain rate of 0.003 min^{-1}. The investigation included experimental data on the nominal stress-strain characteristics, the temperature dependence of yield strength, ultimate strength, fracture strength, elongation, and the elastic modulus. The data indicate the possibility of strain-aging phenomena in the range 300° to 500°.

ROSS, A. M. See abs. 132.

749. ROSS, P. A. K Absorption Discontinuities of the Elements Zirconium to Iodine. Phys. Rev., vol. 44, Dec. 15, 1933, pp. 977-983.

A study of the K absorption limits in the elements Zr, Cb, Mo, Ru, Rh, Pd, Ag, Cd, Sn, Sb, Te, and I has been made with a double-crystal spectrometer. All of the elements studied except cadmium show faint fine structure on the high frequency side of the discontinuity, the structure appearing as narrow bands of slightly decreased absorption lying within a range of from 21 to 120 volts of the main discontinuity. The width of the main absorption step in volts has been measured and found to increase with atomic number. Defining the wave-length of the absorption discontinuity as that corresponding to the point of inflection of the main absorption curve values of the wave-length have been obtained to an estimated accuracy of ±0.02 x.u.

750. ROSTOKER, W. Allotropy in the Phase $ZrCr_2$. Jour Metals, vol. 5, No. 2, February 1953, p. 304.

Gives information on the development of the phase equilibrium diagram for the system Zr-Cr. E. T. Hayes and A. H. Roberson of the Bureau of Mines also reported on the same system.

751. ROTH, H. P. Metallography of Zirconium. Metal Progress, vol. 58, No. 5, November 1950, pp. 709-711.

The perchloric-acetic electrolytic method is superior to mechanical polishing and chemical etching for zirconium and zirconium-uranium alloys.

ROTHMAN, A., McKINNEY, D. S., AND WARNER, J. C. Progress Report for January 1952. See abs. 630.

752. ROZSA, J. T. Improvement of Analytical Control for Silica Brick. Jour. Am. Ceram. Soc., vol. 31, No. 10, Oct. 1, 1948, pp. 280-283.

The prevalent use of silica brick has focused attention upon the need for control and improvement in quality. A review of the methods available reveals that many laboratory tests have been developed to avert expensive trial testing. It is significant, however, that the chemical knowledge of this product has lagged owing to (1) difficult in sampling,

Generated on 2024-09-20 18:01 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

(2) the tedious and time-consuming aspects of wet chemical methods, and (3) the consequent lack of knowledge of the deleterious effects of certain secondary constituents. One of the newer analytical tools is the spectrograph. A total-energy method has been developed to permit analysis of Al_2O_3, MgO, Fe_2O_3, CaO, Na_2O, TiO_2, K_2O, ZrO_2, MnO_2, and Li_2O. Thirty minutes are required for sample preparation and twenty-five minutes for the spectrographic process. Present accuracy is well within production limits. This method is also suitable for the analysis of glass sand.

753. RUNDLE, R. E., WILSON, A. S., NOTTORF, R., AND RAEUCHLE, R. F. Crystal Structures of ThH_2 and ZrH_2. Atomic Energy Comm., AECD-2120, July 19, 1948, 5 pp.

ThH_2 is at least pseudotetragonal with a 4.09, c = 5.02 kX, Z = 2, pseudo-isomorphous with ZrH_2. Both ThH_2 and ThC_2 seem to require more complex units, but the extra weak lines in their powder patterns suggest that they are not truly isomorphous. The possible hydrogen positions in the hydrides are examined, and it is concluded that a structure containing M-H bridges is the most probable. The bond distances for this structure are in fair agreement with predictions from Pauling's rule, with the exception of rather long Th-Th distances in ThH_2.

754. RUNNELS, R. T., UTTER, M. G., AND REED, A. C. Determination of Ferric Oxide and Titania in Presence of Alumina. Jour. Am. Ceram. Soc., vol. 33, No. 2, February 1950, pp. 51-53.

A study of cupferron reagent as applied to quantitative analyses of ceramic materials shows acceptable results in both precision and accuracy. The oxides Fe_2O_3, TiO_2, ZrO_2, and V_2O_5 are separated from Al_2O_3 and P_2O_5; the ferric oxide is determined directly from the ignited mixed oxides by titration with $K_2Cr_2O_7$. The oxide TiO_2 is ordinarily the main constitutent in the $Ro_2 + R_2O_5$ group and is reported as TiO_2 by difference.

RUPP, A. F. See abs. 707.

755. RUSSELL, R., JR., AND MOHR, W. C. Characteristics of Zircon Porcelain. Jour. Am. Ceram. Soc., vol. 30, No. 1, 1947, pp. 32-35.

The manufacturing characteristics, properties, uses, and future possibilities of zircon porcelain are discussed. Any of the usual manufacturing processes may be used, but special glazes must be employed because zircon absorbs normal glazes: The typical properties (approximate values) are: 1. Linear expansion, 4.5 x 10^{-6} per °C.; 2. thermal conductivity, 0.012 (normal porcelain, 0.004); 3. tensile strength, 13,000 lb. per sq. in.; 4. compressive strength, 100,000 lb. per sq. in.; 5. modulus of elasticity, 25 x 10^6 lb. per sq. in.; 6. thermal-shock resistance, good; 7. power factor at 1 mc., 0.001; and 8. dielectric constant, 9.

756. RUSSELL, R. B. Coefficients of Thermal Expansion for Zirconium. Massachusetts Inst. Technol., MIT-1073, Oct. 19, 1951, 41 pp.

The expansion coefficients of anisotropic (hexagonal) zirconium have been calculated from the lattice parameters of an alloy containing 2.4 weight-percent (1.2 at. percent) Hf, from 0° - 600° C. (32° - 1,112° F.). The lattice parameters were determined by Cohen's method from data obtained by X-ray diffraction of zirconium sheet heated in vacuo. Expansion coefficients are expressed as true linear and volume coefficients, mean linear and volume coefficients, and resultant linear for different expansion directions in a single crystal. It is found that the true and mean coefficients are very nearly a straight line function of the temperature, as would be expected from the relatively low characteristic temperature of zirconium (280° K.). Some results are reported for the effect of hafnium on the lattice parameters of

Generated on 2024-09-20 18:01 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

zirconium. Gruneisen's constant has been evaluated by three different methods, using compressibility, heat capacity, and heat of sublimation values from the literature.

RUTHER, W. E. See abs. 620.

757. RUTHERFORD, N. B. Effect of Mould Material and Alloying Elements on Metal/Mould Reaction in Copper-Base Alloys. Jour. Inst. Metals, vol. 18, No. 10, June 1951, pp. 189-210.

When a metal is cast in a sand or other mould in which a steam atmosphere is generated, it reacts with the steam and may absorb hydrogen during the reaction. The term 'metal/mould reaction' is used to describe this effect. Procedures and results are described in detail of experiments to determine the influence of different materials on the mould reaction in phosphor bronze containing 10 percent tin and 0.5 percent phosphorus. The effects of variations in the moisture content and permeability of natural and synthetic sands were examined, as well as the effect of adding mineral- and vegetable-oil, cereal, resin, and cellulose-derivative core binders; mould reaction of varying intensity occurred in all cases. A sprayed mould coating of blacking was found to increase mould reaction when applied to a high-permeability synthetic sand, but to have only a small effect with a low-permeability natural sand. The protection afforded by a coating of aluminum paint varied considerably, but an aluminum-magnesium alloy paint coating prevented reaction with both naturally bonded sand and various core sands. Individual additions were made of bituminous coal, sulfur, ammonium bifluoride, and boric acid to clay-bonded synthetic sand; of these, the bifluoride produced a high degree of inhibition and the boric acid may have had a very slight inhibiting effect. The influence of various minor alloying additions on the mould reaction in certain copper-base alloys was studied also. Silicon was found to inhibit mould reaction in lead-free gun-metal containing 0.1 percent phosphorus, as it does in phosphor bronze. Leaded gun-metals containing 0.03 percent silicon or more yielded castings with poor surfaces and with increased porosity, which is attributed to the incidence of mould reaction. In phosphor bronze, mould reaction was inhibited by additions of 0.1 percent aluminum, 0.5 percent chromium, 0.1 percent vanadium, 0.1 percent boron, and possibly by small amounts (0.01 percent) of calcium. Running practice probably would need to be modified if additions of aluminum or chromium were adopted on a production scale and perhaps with vanadium and boron also, because of the formation of tenacious oxide skins. Mould reaction in phosphor bronze was intensified by adding 0.5 percent iron or manganese, or 0.2 percent magnesium, whereas additions of 0.5 percent nickel, 0.1 percent beryllium or small amounts of barium or sodium had no effect. A number of theoretical considerations are discussed.

RYON, A. D. See abs. 509.

758. RYSCHKEWITSCH, E. Ceramic Materials of Pure Oxides. Chem. and Ind., vol. 57, Oct. 15, 1938, p. 965.

This article contains a description of some new ceramic materials that have the advantage of being more uniform and more permanent than many of the ceramic materials used in the past. The new materials, including zirconia, are especially suitable for tubes and rods in thermionic valves, for heating girders in electric furnaces and for high vacuum use at temperatures above the melting points of quartz and platinum, for instance the distillation of metals where purity is essential. They are useful in measuring the vapor pressure of difficultly fusible metals, for pyrometer protection tubes and are in many other operations at low temperatures superior to the substances now commonly in use.

759. _____. Compression Strength of Porous Sintered Alumina and Zirconia. Jour. Am. Ceram. Soc., vol. 36, No. 2, February 1953, pp. 65-68.

Generated on 2024-09-20 18:09 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The influence of controlled porosity on the compression strength of sintered pure alumina and of partly magnesia-stabilized zirconia was investigated. Bodies with porosities ranging from approximately 3 to 60 percent, by volume, were prepared utilizing hydrogen peroxide to induce pore formation. Cubes of approximately 1.2-cm. unit length were used in testing for compression strength at room temperature. The spatial arrangement of pores in sintered alumina was found to exert an influence, inasmuch as bodies with pores lined parallel to the pressure direction revealed a higher strength than bodies of the same porosity but with pores lined mainly perpendicular to this direction. It was found that an increase of porosity by 10 volume percent decreased the strength of both sintered alumina and sintered zirconia by half of their initial respective values.

760. RYSCHKEWITSCH, E. Properties and Physical Constants Data of High Refractory Materials. Wright-Patterson Air Force Base, AF Tech. Report 6330, August 1950, 27 pp.

Data on the properties and physical constants of high refractory elements, oxides, carbides, nitrides, and combinations are presented.

761. _____. Rigidity Modulus of Some Pure Oxide Bodies, 8th Communication to Ceramography. Jour. Am. Ceram. Soc., vol. 34, No. 10, Oct. 1, 1951, pp. 322-326.

Rigidity modulus of several sintered pure oxides was measured using specially prepared test pieces. A particular form of samples permitted an exact measurement of their dimensions and insured their proper elastic torsion deformation under a given load. Sintered alumina was tested up to 1,550° C. Monocrystalline corundum, sintered stabilized zirconia, sintered pure beryllia, thoria, spinel, and zircon were tested at room temperature. Close agreement was noted between rigidity modulus values and Young's modulus values.

SADEK, E. A. See abs. 69.

SAFRANSKI, L. W. See abs. 860.

762. SAGANE, R., KOJIMI, W., IKAWA, M., AND MIYAMOTO, G. Artificial Radioactivity Induced in Zr and Mo. Phys. Rev., vol. 57, June 15, 1940, pp. 1179-1180.

A study of radioactivity produced in zirconium and molybdenum by bombardment of neutrons.

763. _____. Preliminary Report on the Radioactivity Produced in Y, Zr, Cb, and Mo. Phys. Rev., vol. 54, 1938, pp. 542-543.

A study of radioactivity produced in Y, Zr, Cb, and Mo, has been carried out by neutron bombardments on these elements from the cyclotron.

SAITTA, V. F. See abs. 168.

SAKAKURA, A. Y. See abs. 132.

SALLER, H. A. See abs. 824.

764. SALLER, H. A., AND DICKERSON, R. F. Metallographic Identification of Nonmetallic Inclusions in Zirconium. Battelle Mem. Inst., BMI-74, July 1, 1951, 27 pp.

Preliminary investigations indicate that there are certain typical modes of occurrence for the carbides, oxides, hydrides, and nitrides of zirconium. Carbides occur as broken stringers or as spheroids, which appear isotropic under polarized light. The inclusion believed to be the oxide occurs not only within the grains but also along grain boundaries. Although not identified, the nitrogen-rich areas in the iodide-zirconium may be the nitride inclusion. The 'spiny' rough-edged inclusion, that is frequently observed in iodide zirconium, is believed to be a hydride; this inclusion appears as continuous stringers. Metallographic specimens were prepared by various methods, depending upon the inclusion to be studied and the structure desired. The

Generated on 2024-09-20 18:01 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

methods of preparation and identification are discussed.

765. SALLER, H. A., AND DICKERSON, R. F. Notes from the Second Metallography Conference. Battelle Mem. Inst., Jan. 11, 1950, 12 pp. AECU-1235.

Covers several discussions held at the Metallography Conference at Battelle Memorial Institute on January 11, 1950, on metallographic techniques applicable to zirconium, titanium, vanadium, and beryllium.

766. SANDERSON, L. Zirconium and Its Uses. Canadian Min. Jour., vol. 59, December 1938, pp. 692-693.

A general discussion of zirconium, including ores, sources, extraction from ores, extraction of metallic zirconium and uses.

767. SANTMYERS, G. S. Processing and Use of Zircon for Refractory Electrical Insulating Compositions. Frontier, vol. 9, No. 4, 1946, pp. 12-14.

High-grade zircon, secured from crude concentrates imported into the United States, has in recent years been used to manufacture refractory electrical insulating compositions. Ordinary mineral beneficiation methods do not produce a sufficiently pure product. However, when these methods are used in conjunction with recently developed electrostatic methods of separation, a zircon of virtually 100 percent purity is obtained.

SARTAIN, C. C. See abs. 739.

768. SATO, T. R., DIAMOND, H., NORRIS, W. P., AND STRAIN, H. H. Electrochromatographic Separations of Rare Earths. Jour. Am. Chem. Soc., vol. 74, No. 23, Dec. 5, 1952, pp. 6154-6155.

Procedure is given for electrochromatographic separations of rare earths.

769. SAUNDERS, W. P., AND STRIETER, F. P. Alloying Zirconium to Magnesium. Trans. Am. Foundrymen's Soc., vol. 60, 1952, pp. 581-588.

An investigation was conducted on the merits of several zirconium containing materials for alloying this metal to magnesium. The study included the use of various mixtures containing $ZrCl_4$, several agents containing ZrF_4, various forms of metallic zirconium, and some master alloys. In general, it was found that several of the above materials were suitable. The use of a master alloy containing about 40 percent zirconium, balance magnesium, appears to possess many advantages over both metallic zirconium and zirconium salts.

770. SAWAGUCHI, E. /Ferroelectricity Versus Antiferroelectricity in the Solid Solutions of $PbZrO_3$ and $PbTiO_3$./ Jour. Phys. Soc. (Japan), vol. 8, No. 5, September-October 1953, pp. 615-629.

The phase diagram of the solid solutions of $PbZrO_3$-$PbTiO_3$ system has been established by investigating dielectric, dilatometric, calorimetric, and structural properties. In $Pb(Zr97\text{-}Ti3)O_3$ four kinds of polymorphic modification have been found, that is, successively, the antiferroelectric, the other antiferroelectric, the ferroelectric and the paraelectric phases. By using the phase diagram and the forced transition that causes a phase change from antiferroelectric phase to ferroelectric owing to an influence of intense electric field, the free energies of these four states have been compared with one another as functions of temperature and the concentration of the solid solution. It is found that the antiferroelectric phase near the Curie point 230° C. in pure $PbZrO_3$ is more stable than the ferroelectric one by only about 4 cal./mole; and with increasing concentration of $PbTiO_3$ the free energy of the ferroelectric phase decreases gradually at an initial rate of 0.5 cal./mole/atomic

Generated on 2024-09-20 18:01 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

percent. At the same time the 2 antiferroelectric phases lose their stability at the rates 5.8 cal./mole/atomic percent and 2.3 cal./mole/atomic percent, respectively. The atomic arrangement in the ferroelectric Pb(Zr-58-Ti42)O_3 has been examined. The sample of this concentration has the rhombohedral structure C_{3v}^5-R3m: The displacement of Pb atom relative to Zr or Ti atom is about 0.14 KX along the (111) direction.

771. SAWAGUCHI, E., MANIWA, H., AND HOSHINO, S. Antiferroelectric Structure of Lead Zirconate. Phys. Rev., vol. 83, 1951, p. 1078.

The authors discuss the structure of $PbZrO_3$ as determined by oscillation and powder photographs and conclude that the main part of the dipole moment must lie in the a-b plane bearing an antiferroelectric arrangement.

SAWYER, D. L. See abs. 75.

772. SCARBOROUGH, J. M., AND PLUCKNETT, W. K. Vapor Pressure of Zirconium Tetrachloride by Molecular Effusion. Ames Lab., Iowa State College, ISC-92, December 1950, 31 pp.

The methods of determining low vapor pressures have been reviewed. Emphasis has been placed on molecular effusion, including a theoretical discussion and the subsequent application of molecular beams to the determination of vapor pressure. The problems met in the preparation, purification, and handling of anhydrous zirconium tetrachloride have been discussed. Vapor pressure measurements on zirconium tetrachloride have been made over a temperature range of 50 degrees, 70° to 120° C. and the mean molar heat of sublimation for this temperature range has been calculated. The value of 20.3 kcal. per mole obtained is not unreasonable in view of the fact that values for the same quantity determined by other investigators in the temperature range of 239° to 346° C. is reported to be 24.4 kcal. per mole.

773. SCHAUM, J. H., AND BURNETT, H. C. Magnesium-Rich Side of the Magnesium-Zirconium Constitution Diagram. Nat. Bureau of Standards Research Jour., vol. 49, No. 3, September 1952, pp. 155-162.

The magnesium-rich side of the magnesium-zirconium constitution diagram has been studied to improve the previous work on this subject. A diagram has been developed that is similar in form to that found by previous investigators, but the phase boundaries differ as to temperatures and alloy compositions. The peritectic reaction was found to take place at 654° C. beginning at 0.58 percent of zirconium.

SCHEER, C. L. See abs. 7.

774. SCHENCK, R. B. Special Addition Agents. Steel, vol. 113, No. 14, 1943; pp. 96-98, 100, 102, 104, 130.

Special additive agents are a group of ferroalloys containing boron, which have the property of markedly increasing the hardenability of many steels when added in relatively small amounts. These agents including zirconium are known as 'intensifiers.' They promise replacement of such elements as nickel, chromium, and molybdenum.

775. SCHICKNER, W. C., BEACH, J. G., AND FAUST, C. L. Electroplating on Zirconium. Battelle Mem. Inst., BMI-707, Nov. 15, 1951, 26 pp. AECD-3334.

Methods are described for bonding nickel and iron electroplates to crystal-bar and Bureau of Mines zirconium. The process uses heat treatment of the as-plated zirconnium to cause diffusion at the plate-zirconium moduli of rupture: 55,000 p.s.i. for nickel and 40,000 p.s.i. for iron. Nickel or iron, diffusion bonded to zirconium, can be a basis for subsequent electroplating with other metals.

Generated on 2024-09-20 18:06 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

776. SCHICKNER, W. C., BEACH, J. G., AND FAUST, C. L. Electroplating on Zirconium. Electrochem. Soc., vol. 100, No. 6, June 1953, pp. 289-291.

Methods are described for producing adherent electroplates on zirconium. As-plated adhesion (about 6,000 p.s.i.) is obtained by prescribed etching of the zirconium surface before plating. Prebaking and heat treatment of nickel- or iron-plated zirconium produces alloy bonds of about 50,000 p.s.i. (as indicated by modulus of rupture). Other metals are electroplated over diffusion bonded nickel or iron plate.

777. _____. How to Braze and Solder Zirconium. Steel, vol. 132, No. 18, May 4, 1953, pp. 118-119.

Zirconium is important in atomic power plants because of its corrosion resistance and favorable neutron properties. After dipping in zinc chloride, it can be soldered and brazed.

778. _____. Surface Preparation of Zirconium for Brazing. Battelle Mem. Inst., BMI-758, July 1, 1952, 7 pp.

Describes a method for applying a replacement zinc film on zirconium and zirconium alloy surfaces. Zinc-coated zirconium or zirconium alloy can be soft soldered and silver soldered using conventional techniques.

SCHLAIN, D. See abs. 277.

779. SCHLAIN, D., KENAHAN, C. B., AND STEELE, D. V. Galvanic Corrosion Behavior of Titanium and Zirconium in Sulfuric Acid Soluions. Jour. Electrochem. Soc., vol. 102, No. 3, March 1955, pp. 102-109.

Aluminum alloys are the anodic members of titanium-aluminum alloy couples in dilute sulfuric acid solutions in the presence of air. In stronger acid solutions, particularly when air is absent, aluminum alloys are anodic only at the beginning of the immersion period. After an induction period titanium becomes anodic. Aluminum alloys are always anodic in zirconium alloy couples immersed in sulfuric acid solutions. The rate of galvanic attack increases with the supply of air. The direction of flow of the galvanic current is always in agreement with the relative values for the electrode potentials of the single metal specimens. Little, if any, galvanic corrosion occurs in couples of titanium or zirconium with stainless steel, although there are generally sizeable differences of potential between single specimens of these metals. The composition of zirconium and titanium is also given.

SCHLECHTEN, A. W. See abs. 504, 507, 508.

780. SCHLEICHER, H. M. Carteret Zircon - A Versatile Ceramic. Ceram. Age, vol. 50, No. 4, April 1949, pp. 200-201.

The problem was to produce suitable pouring nozzles at short notice. The requirements included inertness to molten copper, good thermal shock resistance, smooth bore, and reasonable price. After some experimentation, a method of producing a refractory zircon ceramic was developed which has been practiced since with highly satisfactory results.

781 SCHOELLER, W. R. Investigations Into the Analytical Chemistry of Tantalum, Niobium, and Their Mineral Associates. Analyst, vol. 61, 1936, pp. 806-811.

The principal objects of this research were: (1) The quantitative separation of tantalum and columbium (niobium) from their mineral associates and from each other. This part of the work is of more general importance as it treats of fundamental propositions of analytical chemistry and is by no means confined to earth acid analysis. (2) Qualitative analysis. (3) The tartaric-acid method of mineral analysis. This specialized subject is of more immediate interest to those concerned with the study of earth-acid minerals, although the tartaric-acid method is applicable in the analysis of titanium, zirconium, vanadium, tungsten, and aluminum minerals and alloys.

Generated on 2024-09-20 18:54 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

782. SCHOFIELD, H. Z. Ball Milling of Pure Ceramic Bodies. Ceram. Bull., vol. 32, No. 2, 1953, pp. 49-51.

Experience in the laboratory on ball milling pure ceramic bodies to very fine grain sizes without contamination is reviewed. Mills lined with beryllium, carbon, or rubber and employing balls of beryllium, zirconium, zirconia, magnesia, and carbon have been used successfully in various combinations to mill beryllia, zirconia, magnesia, zirconium carbide, and graphite.

See also abs. 199, 829, 830, 831.

783. SCHOLES, W. A., AND KOSHUBA, W. J. Investigation of Some Metal-Ceramic Combinations as Coating Materials. Fairchild Engine and Airplane Corp., Mar. 6, 1951, 10 pp. NEPA-1790.

The purpose of this work was to investigate some metal-ceramic combinations. Many of these had been reported to form solid solutions between the metallic and nonmetallic phases. It was hoped that the more promising combinations might be useful as protective coatings. The compositions under consideration comprised combinations of the metals titanium, zirconium, and columbium (niobium) with the oxides of aluminum, beryllium, calcium, magnesium, silicon, titanium and zirconium. After thermal treatment to induce reaction between the components, the specimens were subjected to X-ray and metallographic examination to determine the reaction products. Two systems, Ti-ZrO_2 and $ZrZrO_2$, showed positive evidence of solid solution. No interpretable evidence of reaction between metals and oxides was found in the other metal-ceramic combinations investigated. The systems in which definite reactions occurred are not oxidation resistant and are consequently of inferior value as coatings.

784. SCHUBERT, J. Study of the Treatment of Plutonium and Radioyttrium Poisoning by Zirconium Citrate. Argonne Nat. Lab., Sept. 1, 1948, 12 pp. AECD-2358.

A study was made of the effect of a single dose of zirconium citrate on the excretion and distribution of plutonium and radioyttrium in rats and a growing dog. It was found that the administration of zirconium citrate to rats increased the excretion of Pu from 1 percent to 50 percent and that of Y from 25 percent to 60 percent of the injected dose during a 24-hour period. The amount of Pu and Y deposited in the skeleton was reduced by factors of 6 and 2.6, respectively. No significant changes in the Pu or Y contents of the faces, liver, spleen, or kidneys were found. The administration of zirconium citrate to a dog 5 months or 2-1/2 years after exposure to Pu was followed by a sustained increase in the urinary excretion of Pu. The extent of the increase was proportional to the dose of zirconium citrate. Discusses the chemical concepts involved in applying metal displacement principles to the removal of radioactive metals from the body.

785. SCHUBERT, J., AND CONN, E. E. Radiocolloidal Behavior of Some Fission Products. Nucleonics, vol. 7, June 1949, pp. 2-11.

Some of the consequences of radiocolloid formation are explored. The authors summarize experimental results obtained by the techniques of dialysis, ultrafiltration, diffusion coefficient measurement, and ion exchange, which illustrate the radiocolloidal behavior in solution of some of the radioelements that are formed from the fission of uranium.

786. SCHUBERT, J., AND WHITE, M. R. Effect of Sodium and Zirconium Citrates on Blood Level, Distribution and Excretion of Injected Radiolead. Argonne Nat. Lab., February, 1951, 17 pp. AECU-1227; UAC-356.

This investigation studied the distribution and excretion of lead, the rates of disappearance of injected lead from the whole blood, plasma, and blood cells, and compared the effects of sodium and zirconium citrates on the organ

Generated on 2024-09-20 18:13 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

distribution. blood levels, and excretion of lead.

SCHULTZ, B. G. See abs. 524.

SCHUMB, W. C. See abs. 821, 822, 823.

787. SCHUMB, W. C., AND NOLAN, E. J. Arsenate Method for the Determination of Zirconium. Ind. Eng. Chem., anal. ed., vol. 9, No. 8, 1937, pp. 371-373.

Gives experimental work, procedures, materials in the arsenate method of zirconium determination. Some comparison is made with other procedures, and the precipitation of other metals is given.

788. SCHUMB, W. C., AND PITTMAN, F. K. Ferrocyanide Method for Separation of Hafnium from Zirconium. Ind. Eng. Chem., anal. ed., vol. 14, No. 6, June 15, 1942, pp. 512-515.

A systematic study of the factors involved in the separation of hafnium from zirconium by the ferrocyanide method proposed by Prandtl has resulted in modifications of the procedure to give the maximum degree of separation. The factors studied include the dilution and acid concentration, each of which affect the extent of hydrolysis of the zirconium and hafnium ferrocyanides precipitated, the amounts of ammonium sulfate, oxalic acid and sodium ferrocyanide added, the time interval allowed between precipitations carried out upon the same initial solution. The optimum conditions for each of these factors have been determined.

789. SCHUMB, W. C., SEWELL, E. F., AND EISENSTEIN, A. S. Observations on the Stability of the Barium-Hydrogen and Zirconium-Hydrogen Systems. Jour. Am. Chem. Soc., vol. 69, August 1947, pp. 2029-2033.

In order to provide information concerning the equilibrium conditions of metallic hydrides in hydrogen thyratrons, the equilibrium gas pressures in the barium-hydrogen and zirconium-hydrogen systems have been measured up to 600° and 650°, respectively. Combination of hydrogen with metallic barium occurs readily when the metal is finely divided or in thin layers. The dissociation pressure of barium hydride at 600° appears not to exceed 0.24 mm., which is low in terms of hydrogen thyratron requirements. At this temperature, barium metal begins to evaporate rapidly, rendering its use as a hydrogen reservoir impractical. The equilibrium gas pressure in the zirconium-hydrogen system rises from 0.16 mm. at about 150° to 2.1 mm. at 500°. The variation of the pressure with temperature was found to be relatively independent of the pressure at which the hydride was formed initially. The pressures were reproducible with rising and with falling temperature if an excess of hydrogen present was avoided when the hydride was cold.

790. SCHWARTZ, M. A. Ceramic-Metals for Component Design. Elec. Mfg., vol. 53, No. 4, October 1953, pp. 144-148.

Development of the new 'cermets' opens application possibilities where there is need for special materials, as in highly stressed temperature-resistant parts and high-temperature wear-resistant parts.

791. SCHWARTZ, M. A., AND BERGER, M. J. Report on Zirconium Strontiate. Fairchild Engine and Airplane Corp., October 1947, 11 pp. NEPA-324; IHR-E9.

A general discussion of zirconium strontiate from the standpoint of properties, fabrication, preparation, analysis, equilibrium, structure, and nuclear data. Effects of radiation upon the various properties are covered.

792. SCHWARTZ, M. A., AND KOSHUBA, W. J. Report on the Thermal Conductivity of Some Refractory Materials at Elevated Temperatures. Fairchild Engine and Airplane Corp., April 1949, 18 pp. NEPA-1015; EMR-57.

Generated on 2024-09-20 18:55 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

A compilation was prepared of elevated temperature thermal conductivity data of materials being considered for use as refractories in addition to some which were included for comparative purposes. The importance of this property concerns itself mainly with the transfer of heat from a fuel to a working fluid, and secondly with the prediction of thermal stresses that might occur. Since thermal conductivity is essentially a structure-sensitive property, it is not characteristic of a given chemical compound. Therefore, whenever possible in this report, information concerning the specimens used has been included. The porosity or density, for example, are important factors influencing the thermal conductivity.

793. SCHWEITZOR, G. K., AND JACKSON, M. Radiocolloids. Tennessee University, 1951, 28 pp. ORO-48.

In 1912, while investigating methods for the separation of RaF(Po-210) from RaE(Bi-210) and RaD(Pb-210) in radiolead nitrate, Paneth found that when he dialyzed a solution of radiolead nitrate only the lead isotopes passed through the paper parchment or animal bladder membrane. This observation led to a large number of researches, which established that radiotracers in minute concentrations (generally 10^{-9} M and below) may exhibit behavior similar to that of colloids. These substances have been termed radiocolloids. Various investigators have pointed out that radiocolloids exhibit the following properties: (1) Diminished diffusion velocities, (2) stratification in the presence of gravitational or centrifugal fields, (3) coagulation or peptization by the addition of suitable electrolytes, (4) adsorption upon finely divided materials, filters, walls of containers, and other surfaces (5) inability to dialyze through membranes permeable to ions, (6) discontinuous distribution of the radioactive material which is present as aggregates, as evidenced by radioautographs, and (7) anomalous chemical behavior as evidenced by electrodepositions, nonequivalence of active and nonactive isotopes and ion exchange phenomena.

794. SCHWOPE, A. D. Comparison of Zirconium With Better Known Commerical Metals. Metal Progress, vol. 63, No. 5, May 1953, pp. 75-81.

Zirconium, a transition element characterized by an incomplete inner shell of d electrons, is compared with two other important metals, iron and titanium. Zirconium, iron, and titanium possess allotropic transformations and alloying elements affect these transformations. It is possible to predict, in an empirical way, the effects of minor alloy additions and it appears that alloying of zirconium is similar to the alloying of titanium and iron. Zirconium is also notch brittle, similar to iron. Effect of alloying elements on strength at elevated temperature is also comparable with iron-base and titanium-base alloys.

See also abs. 637.

795. SCHWOPE, A. D., AND CHUBB, W. Small Additions Raise Strength of Zirconium at Elevated Temperatures. Jour. Metals, vol. 4, No. 11, November 1952, pp. 1138-1140.

The effects of small amounts of a number of elements upon the strength of zirconium have been studied. The results agree, in general, with the data available in the literature and show the effects of small additions upon the high-temperature strength of induction-melted zirconium. It is apparent that molybdenum and possibly columbium (niobium) are most effective in strengthening zirconium at temperatures below 500° C., but that aluminum, tantalum and vanadium are most effective in maintaining the strength of zirconium at temperatures above 600° C. Titanium seems to be most effective in the range between 300° and 700° C.

796. SCHWOPE, A. D., AND STOCKETT, S. J. Directional Tensile Properties. Battelle Mem. Inst., BMI-T-32, July 1, 1950, 7 pp.

This report presents the results of a group of tensile tests on sheet zirconium made from zirconium prepared by the

Generated on 2024-09-20 18:01 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Bureau of Mines. The tests were made to determine the effect of directionality in cold-rolled sheet on such properties as the yield strength, ultimate tensile strength, and the modulus of elasticity of zirconium. Another objective was to determine a 'Poisson's ratio' with respect to the length and width of the specimen.

797. SCIENCE AND MECHANICS. Metal With a Future. Vol. 21, No. 2, April 1950, pp. 95-98.

The importance zirconium will play in rocket and atomic research is discussed.

798. SCIENCE NEWS LETTER. Atomic Power Materials, General Science. Vol. 64, No. 6, Aug. 8, 1953, p. 93.

Unusual substances, among them combinations of ceramics and metals known as cermets, are being tested both as moderators and shields for atomic furnaces.

799. SCOTT, A. Hafnium and New Zealand Sand. Nature, vol. 111, No. 2792, May 5, 1923, p. 598.

A discussion of the discovery of hafnium in black titaniferous New Zealand sand.

SCOTT, C. C. See abs. 74.

SCOTT, K. See abs. 343.

800. SCOTT, K. G., OVERSTREET, R., JACOBSON, L., HAMILTON, J. G., FISHER, H., CROWLEY, J., CHAIKOFF, I. L., ENTENMAN, C., FISHLER, M., BARBER, A. J., AND LOOMIS, F. Metabolism of Carrier-Free Fission Products in the Rat. Argonne Nat. Lab., decl. Aug. 26, 1947, 209 pp.

The most significant conclusions that can be derived in the survey of all of the work done with the long-lived fission products can be summarized in the following manner: The alkaline earths, rare earths, zirconium, and columbium when introduced into the body are deposited primarily in the skeleton, where the average degree of retention of the absorbed radio-elements is approximately 50 percent of the initially absorbed quantity. The retained fractions of these radio-elements are eliminated at rates that are less than their rates of radioactive decay with the exception of the 340 day cerium and possibly Sr^{90}. The remaining five long-lived radio-elements, ruthenium, tellurium, xenon, iodine, and cesium do not show any significant degree of localization in the skeleton and in addition, there is no very striking deposition in any other of the tissues with the exception of deposition of iodine in the thyroid. The rates of elimination for all of these four radio-elements are much greater than their rates of radioactive decay, with the exception of iodine accumulated in the thyroid. In this particular case, the release of accumulated iodine in the thyroid is many times slower than its rate of radioactive decay.

SCRIBNER, B. F. See abs. 593.

SEIFERLE, E. J. See abs. 231.

801 SELLIKEN, J. H. Fatigue Properties of Zirconium. Thesis, Oregon State College, May 11, 1951, 48 pp.

The high resistance to corrosion and its moderate tensile strength gives zirconium potential possibilities in structural parts. One of the properties of structural parts is their resistance to repeated stress. The lack of available data on fatigue strength of zirconium and the realization that expensive and long-time tests of this nature are not suited for acceptance tests, has brought about this investigation. Four different lots of arc melted zirconium sheets were received from the Federal Bureau of Mines, Albany, Oreg. The specimens prepared from the first lot were annealed before testing. The remaining 3 lots were cold rolled 8.6 percent, 30 percent, and 42 percent, respectively, with a slight deviation from stated percentages in each lot. Within the knowledge of the author the correlation between endurance limit, cold rolling, and other physical

Generated on 2024-09-20 18:02 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

properties of zirconium had not been studied before this test. The fatigue specimens used in this test were specially designed for the Sonntag Flexure Fatigue Testing Machine SF-2. The factory designation is specimen No. 3, which was designed for sheet material 0.125 inches to 0.25 inches thick. It consisted essentially of a 4-inch strip, 1-1/2 inches wide, with a reduced section 3/4 inch wide at the midpoint. The endurance ratio of the annealed zirconium averaged about 46 percent as compared to about 50 percent for rolled or forged steel. A number of the fatigue specimens developed fatigue cracks away from the reduced section of the specimen and failed because of fretting corrosion where they joined the grips of the machine. Cold rolling caused the zirconium to increase in tensile strength and also caused a reduction in the fatigue strength. No correlation between endurance limit, hardness and cold working could be determined from these tests which could partly be accounted for by the condition of the sheets from which the specimens were prepared. The sheets of 30 percent and 42 percent cold worked had severe surface cracks in some sections and were severely bent in other sections. The 8.6 percent rolled sheet had ripples on the rolled surface caused by the breakdown of the flame-hardened surface of the rollers. The amount of nonmetallic inclusions varied with each lot, which may also partly explain the lack of correlation.

802. SEMMENS, R. D. Laboratory Resistance Welding Unit. Atomic Energy Research Est., AERE M/R-739, England, August 22, 1951, 3 pp.

A laboratory model for the resistance welding of a large variety of metals is described, and has been tried successfully with such combinations of metals as tungsten, tantalum, molybdenum, zirconium, etc. The machine is based on discharge of a capacitor through a welding transformer of low inductance and high coupling factor, the discharge being triggered through an air gap.

803. SEREN, L., FRIEDLANDER, H. N., AND TURKEL, S. H. Thermal Neutron Activation Cross Sections. Phys. Rev., vol. 72, No. 10, November 1947, pp. 888-901.

The activation method of measuring slow neutron cross sections is discussed in connection with the survey made at Argonne Laboratory. A table is given listing 131 activation cross sections of 65 elements and properties of the radio isotopes produced.

SEWELL, E. F. See abs. 789.

804. SHAPIRO, C. L., AND STRAUSS, J. Influence of Various Elements Upon the Position of the Eutectoid in the Iron-Carbon (Carbide) System. Am. Inst. Met. Eng., Tech. Pub. 1646, 1943, 19 pp.

This is a critical examination of the theory that the amount of carbon necessary to form the iron-carbon (carbide) eutectoid is lowered by adding any carbide-forming element. Although this theory has been built up over a long period of years, it appears, in the light of recent published investigations upon the ternary constitutional diagrams of iron with carbon and other alloying elements, to be no longer tenable. A survey shows that (as is known) some metals lower the carbon content of the iron-carbon (carbide) eutectoid, whereas others raise it, but (as not heretofore clearly set forth) some first move the eutectoid in one direction and then, at higher concentrations, shift it in the opposite direction. Moreover these differences in behavior exist even among the common alloying metals classed as carbide formers.

SHAPIRO, E. See abs. 565.

SHAPIRO, L. See abs. 3.

SHARP, D. E. See abs. 412, 413.

SHAW, L. I. See abs. 446.

Generated on 2024-09-20 18:05 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

805. SHEA, J. F. Separation of Zirconium and Hafnium. Battelle Mem. Inst., June 30, 1949, 35 pp. AECD-2979.

Petrographic, X-ray and analytical studies were made on synthetic and natural zirconium minerals containing varying amounts of hafnium. The objectives of these studies were to determine the mode of occurrence of hafnium in zirconium ores; to devise some physical method for reducing the hafnium content of zirconium ores, and to develop, if possible, some comparatively simple aids or methods for use in prospecting for zirconium ores low in hafnium. This is the final report on this phase of subject matter of Contract No. AT 30-1-Gen-228. The data obtained during the entire program, pertinent to the objectives of the research, are assembled in it.

806. SHELTON, S. M. Zirconium. Sci. American, vol. 184, No. 6, June 1951, pp. 18-21.

Extraordinarily resistant to heat, corrosion, and hard radiation, yet malleable and ductile, the metal meets some of the stern engineering requirements of nuclear reactors and jet engines.

807. SHELTON, S. M., AND DILLING, E. D. Manufacture of Zirconium Sponge. Bureau of Mines, undated, 39 pp.

Low neutron absorption coupled with the resistance to corrosion make ductile zirconium a promising structural material for nuclear power reactors. A brief historical sketch recounts the development of the magnesium-reduction process by the Bureau of Mines, Northwest Electrodevelopment Laboratory, Albany, Oreg. In February 1945, 90 grams of zirconium metal was produced at the laboratory. Technological advancement and expansion of production facilities since that date have resulted in an annual rated capacity of 270,000 pounds of clean zirconium sponge. Major steps in the magnesium-reduction process that are covered in detail include: Chemical purification, chlorination, reduction, vacuum distillation, sponge handling, and melting.

808. SHEPARD, O. C. Investigation of Materials for Use in a Heat Transfer System Containing Molten Lead Alloys. Progress Report No. 1. Stanford University, July 1950, 9 pp. ORO-20.

This report covers investigation of materials for use with liquid lead-bismuth alloys. Materials being studied are: Stainless steel type 446, tantalum, columbium, molybdenum, titanium, zirconium, tungsten, and cobalt.

809. SHERWIN, C. W. Conservation of Momentum in the Beta-Decay of Y^{90}. Phys. Rev., vol. 73, No. 10, May 15, 1948, pp. 1173-1177.

Monolayer sources of yttrium (90) are formed by evaporation in a vacuum of 10^{-7} mm. of Hg. The momentum of individual recoil ions is measured by timing their flight in a field free space. The positively charged Zr(90) recoils appear to lose about 6-electron volts energy as they escape from the surface. If a 6-electron volt correction is made to the observed recoil spectra, there is good agreement regarding shape and absolute amplitude with those recoil spectra calculated on the assumption of a neutrino-electron angular correlation function of $(1-\beta\cos 0)^{28}$. For this function, the most probable angle between the neutrino and the electron is ~ 135°. These results are in agreement, within experimental error, with earlier data obtained with P^{32}. The exact limits of error due to chemical effects at the surface cannot yet be assigned, so it is not possible to make a definite selection of the form of the neutrino-electron angular correlation function.

SHERWOOD, G. R. See abs. 324.

810. SHINODA, G. X-ray Investigations on the Thermal Expansion of Solids. Memorial College of Science, Kyoto Imperial University, A-17, 1934, pp. 27-30.

Generated on 2024-09-20 18:07 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The thermal expansion coefficients of Mg, Cd, Zr, and Co were determined by the X-ray method, and the following results were obtained: Mg(α_{11} = 23.8x10-6, $\alpha\perp$ = 23.5x10-6), Cd(α_{11} = 50.0x10-6, $\alpha\perp$ =17.9x10-6), Zr(α_{11} = 2.5x10-6, $\alpha\perp$ = 14.3x10-6), and Co(α_{11} = 16.1x10-6, $\alpha\perp$ = 12.6x10-6). In this experiment, the thermal expansion coefficients of several hexagonal elements were determined by X-ray analysis.

811. SHORE, F. J., BENDEL, W. L., AND BECKER, R. A. 4.4-Minute Radiations From Zr^{89}. Phys. Rev., vol. 83, 1951, pp. 688-689.

A 180° magnetic spectrometer is used to investigate 79.3-hour Zr^{89}. The subatomic data of other investigations are compared and a proposal is made for a partial-level scheme for the transition between the metastable state of Zr^{89} and the ground state of Y^{89} to substantiate the results.

812. SHULL, C. G., AND WOLLAN, E. O. Coherent Scattering Amplitudes as Determined by Neutron Diffraction. Phys. Rev., vol. 81, No. 4, Feb. 15, 1951, pp. 527-535.

The coherent scattering properties of nearly 60 elements or nuclides for slow neutrons have been determined by neutron diffraction techniques and are summarized in the present paper. The phase of scattering and values for the coherent scattering amplitude and cross section and for the total scattering cross section are given. Pronounced differences in isotopic scattering properties have been found and many nuclides are shown to possess strong spin-dependent scattering properties. Illustrations of thermal diffuse scattering and nuclear spin incoherent scattering are given.

SIBERT, M. E. See abs. 818.

813. SIBERT, M. E., AND STEINBERG, M. A. Production of Zirconium by Fused Salt Electrolysis. Horizons, Inc., Aug. 30, 1951, 24 pp. NYO-3116.

A method for producing high-purity zirconium metal powder by electrolysis of fused salts has been developed. This method consists in electrolyzing fused mixtures of $K_2Zr\text{-}F_6$ and NaCl under an inert atmosphere of argon at approximately 1,000° C. A variety of conditions have been investigated and the optimum conditions of current density, voltage, temperature, cathode material, and cathode spacing have been determined. A procedure for washing and leaching the deposited metal has been elucidated. Some samples obtained have been analyzed for purity. A zirconium content of 99.7 percent purity has been obtained with an oxygen content as low as 0.09 percent.

814. _____. Production of Zirconium by Fused Salt Electrolysis, Technical Progress Report, Second Quarter. Horizons, Inc., September-November 1951, 27 pp. NYO-3117.

A further report on the development of an electrolytic process for production of pure zirconium metal is given herein. The process has been previously described and briefly entails the electrolysis of potassium fluozirconate in a medium of fused sodium chloride under an inert atmosphere. A new cell capable of producing 150 gm. or more of metal from 5 pounds of melt has been designed and constructed. A number of runs using this unit are described, and results thoroughly evaluated in terms of oxygen, nitrogen, and carbon contents of the deposits. Samples were also arc melted and hardness values taken. Some spectrographic analysis and corrosion testing has also been done. Complete descriptions of equipment used are included and the analytical technique used is outlined.

815. _____. Production of Zirconium by Fused Salt Electrolysis, Technical Progress Report, Third and Fourth Quarters. Horizons, Inc., June 18, 1952, 23 pp. NYO- 3118.

Further work toward development of the double fluoride process for production of zirconium electrolytically is

Generated on 2024-09-20 18:05 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

disclosed in this report. Details of the process have been given in previous reports. Emphasis in this phase of the work has been placed on expansion and modification of the electrolytic cells. A modified cell has been designed and two of the units have been completed. This cell allows for greater flexibility of operation and will provide for expanded efforts on the process. Design of the cell is fully described herein. The research program currently in progress emphasizes purity of materials and other modifications aimed at increasing particle size and minimizing impurity contents. Recrystallization and vacuum drying techniques have been successful in this respect. Some physical testing and metallographic work has been carried out on arc-melted specimens and is also reported. Extensive analytical work and screen analysis has been done. A complete summary of this data is given in this report.

816. SIBERT, M. E., WAGNER, F. C., AND STEINBERG, M. A. Production of Zirconium by Fused Salt Electrolysis, Technical Progress Report, Fifth Quarter. Horizons, Inc., Sept. 8, 1952, 32 pp. NYO-3119.

The present discussion is in the nature of an evaluation of the new cells described in the previous report for the third and fourth quarters. The present development is primarily in the direction of technological improvement such that a consistently good product may be obtained repetitively on a given cell. The present cells have proved satisfactory after some revisions to prevent excessive iron contamination. Considerable work has been done toward exploiting the process on a semicontinuous basis. Included in the present reports are complete evaluations of the metal produced through analytical techniques, screen analysis, and hardness testing. A section on physical metallurgical properties is included also. With the present procedure, deposits of 99.8 percent Zr and 50-60 percent + 100-mesh with a Rockwell hardness in the B-85 range are regularly produced.

817. RAYNES, B. C., WAGNER, F. C., AND STEINBERG, M. A. Production of Zirconium by Fused Salt Electrolysis, Technical Progress Report, Sixth Quarter. Horizons, Inc., Dec. 18, 1952, 18 pp. NYO-3120.

The production of zirconium metal by this process on a larger scale is discussed. An electrolytic cell capable of producing 4 pounds of zirconium metal during one 8-hour day is described. The results of 23 runs in this cell are tabulated and evaluated. It has been established that the production of zirconium by this electrolytic process is completely feasible on an enlarged scale and therefore, would be feasible for large pilot-plant operation. Included in this report are analytical evaluations of the zirconium produced, the hardness of the metal produced, and typical screen analyses. In the section on physical metallurgical properties, the identification of a hydride phase has been confirmed in the metal. During the quarter about 46 pounds of zirconium with a Rockwell hardness in the B-88 or less range has been produced. Current efficiencies averaging 50 percent for these runs have been experienced. As the operation procedures are becoming better fixed for this scale operation, it is expected that purity, hardness, and overall yield will be improved.

818. STEINBERG, M. A., SIBERT, M. E., RAYNES, B. C., AND WAINER, E. Extractive Metallurgy of Zirconium by the Electrolysis of Fused Salts, Final Report (Production of Zirconium by Fused Salt Electrolysis, Final Report). Horizons, Inc., Feb. 15, 1953, 205 pp. NYO-3121.

An intensive investigation of the production of zirconium by the electrolysis of fused salt baths containing halides ($ZrCl_4$) and double halides (K_2ZrF_6) of zirconium was undertaken. Special electrolytic cells, heated by carbon resistors and operating in an inert atmosphere of argon were designed and constructed for this work. Current and

Generated on 2024-09-20 18:11 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

voltage controlling and recording equipment was designed and constructed so that accurate data could be obtained on the decomposition potentials of the halides utilized and the electrical characteristics of the many electrolytes investigated. A survey of over 80 bath compositions utilizing these two compounds has been carried out to determine a suitable electrolyte for zirconium production. The conditions for the formation of diffusion plates of zirconium, the recovery of zirconium in liquid cathodes and the cathodic production of zirconium as a loosely held, coarse, dendritic powder have been determined. A simplified fused salt bath containing 25 to 35 percent K_2ZrF_6 in NaCl has proved to be superior to other electrolytes for producing zirconium. High current densities and temperatures of the order of 850°-900° C. yield the optimum results, producing coarsely granular zirconium metal powder easily recoverable by a simple washing technique. At high temperatures and lower current densities diffusion plates of zirconium on various base metals can be obtained.

819. SIDHU, S. S. Deuterium Effect on Hydrogen Bond Distances in Hafnium Dihydride. Jour. Chem. Phys., vol. 22, No. 6, June 1954, pp. 1062-1063.

X-ray diffraction data obtained for carefully prepared and annealed samples of HfH_2 and HfD_2 show that as deuterium substitutes for hydrogen atoms the hafnium-hydrogen bond distances decrease. The lattice as a whole contracts, and the density increases. Presents powder diffraction patterns and the structure data for the two compounds. Experimental procedures are given and data are presented in table form.

SILKES, B. See abs. 160.

820. SIMPSON, C. T., AND CHANDLEE, G. C. p-Hydroxyphenylarsonic Acid as a Reagent for Titanium and Zirconium. Ind. Eng. Chem., anal. ed., vol. 10, No. 11, Nov. 15, 1938, pp. 642-643.

p-Hydroxyphenylarsonic acid has been found an advantageous reagent for separating titanium from the following ions: Ferric, ferrous, aluminum, zinc, cobalt, nickel, beryllium, chromic, manganous, calcium, magnesium, thallium, cerous, thorium, sodium, potassium, and ammonium, as well as phosphate, molybdate, chromate, vanadate, permanganate, uranyl, and vandyl. Interfering ions are zirconium, cerium (ic), and tin. Hydrogen peroxide also must be absent. The reagent may be used to determine zirconium in the presence of the above ions. Phosphate in more than very small amounts interferes. Zirconium may be separated from titanium if hydrogen peroxide is present. Cerium (ic) and tin interfere.

821. SIMPSON, S. G., AND SCHUMB, W. C. Determination of Zirconium in Steels. Ind. Eng. Chem., anal. ed., vol. 5, No. 1, Jan. 15, 1933, pp. 40-42.

Zirconium can be satisfactorily determined in steels by precipitation from dilute hydrochloric acid solution with selenious acid in the presence of hydrogen peroxide and ignition of the precipitate to zirconium dioxide. The method has been found applicable to steels containing elements ordinarily present in zirconium steels. The presence of tungsten may cause contamination of the final selenite precipitate and requires an additional step in the procedure.

822. _____. Determination of Zirconium in Steels. Ind. Eng. Chem., anal. ed., vol. 5, No. 3, May 15, 1933, pp. 211-212.

In the analyses made by the proposed selenious acid phosphate method, 3 grams of a plain carbon steel were dissolved and to the solution were added measured amounts of zirconyl chloride solution corresponding to 0.11, 0.28, and 1.41 percent of zirconium in the original steel. In addition, 20 mg. each of other metals in the form of solutions of their salts were added. The results obtained are given.

Generated on 2024-09-20 18:07 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

823. SIMPSON, S. G., AND SCHUMB, W. C. Selenite-Phosphate Method for Determining Zirconium in Ores. Ind. Eng. Chem., vol. 7, No. 1, 1935, p. 36.

Gives a fairly accurate method for determining zirconium in ores and alloys.

824. SIMS, C. E., SALLER, H. A., AND BOULGER, F. W. Relative Deoxidizing Powers of Some Deoxidizers for Steel. Metals Trans., vol. 185, November 1949, pp. 814-825.

In experimental work to test the deoxidizing powers of commonly available elements, manganese, vanadium and calcium were found to be no stronger than silicon. None of these is able to reduce the FeO content of steel enough to for No. II type sulfides. Magnesium is somewhat doubtful but is disqualified as a deoxidizer from a practical standpoint. Aluminum, zirconium, titanium, and boron all are capable of producing No. II type sulfides. On a comparison basis, aluminum and zirconium seem to be about equal and are the strongest deoxidizers of the elements tested. Titanium is next, though considerably weaker, while boron is not quite as good as titanium. Alumina (acid-insoluble aluminum) was found to be quite constant in carbon steel for a wide range of residual aluminum contents. This is explained on the postulate that it was in solution in the molten steel as AlO, which precipitated and disproportionated to Al_2O_3 + Al during freezing. The theory that deoxidation is primarily a homogeneous reaction involving monoxides of Fe and the deoxidizing element is expounded. Oxides above the solubility limit precipitate and disproportionate to higher valence oxides. By use of the proper chemical species in deoxidation, equilibrium constants may be obtained that are independent of activity coefficients.

825. SITES, J. R., AND BALDROCK, R. Ionization and Dissociation Studies by Means of a Mass Spectrometer. Carbide and Carbon Chem. Corp., Apr. 30, 1951, 17 pp. Y-754.

This report discusses mass spectrometer studies of many materials that have been used for electromagnetic separation of isotopes. Several compounds not previously used have been investigated and are included.

826. SIZOO, G. J., AND HOOGTEIJLING, P. J. /Radioactivity and Granular Composition of Soil./ Physica, vol. 13, No. 9, November 1947, pp. 517-528.

The content of radioactive material as well as the granular composition of 12 samples from the bottom of the IJselmeer (Zuiderzee) was determined. It was found that the radioactivity increases regularly with the percentage of fine material (grain size $<50\mu$) and also with the specific surface of the mineral part of the material. There is no reason to believe that the presence of radioactive elements is restricted to a special grain size fraction of the fine material. It is suggested that the detected correlation may be related with a preference of special minerals (for example, zircon) for the smaller grain sizes.

SKEWIES, A. F. See abs. 617.

827. SKINNER, G. B., AND JOHNSTON, H. L. Low Temperature Heat Capacities of Inorganic Solids, VIII, Heat Capacity of Zirconium From 14° to 300° K. Jour. Am. Chem. Soc., vol. 73, No. 10, October 1951, pp. 4549-4550.

The heat capacities of hafnium-free zirconium have been measured in the temperature range 14° to 300° K., and the derived thermal functions have been calculated and tabulated at integral values of the temperature over this range. The entropy at 298.16° K. is 9.20 ± 0.04 e.u.

SLACK, C. M. See abs. 191.

828. SLATIS, H., AND ZAPPA, L. /Disintegration of Zr^{95} and Nb^{95}./ Arkiv Fysik, vol. 6, No. 9, 1952, pp. 81-93.

Zirconium oxide was irradiated by neutrons in the Harwell pile and the active zirconium separated from impurities

Generated on 2024-09-20 18:09 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

(mostly Hf) by the ion exchange method (separation performed at this institute by W. Forsling). The beta and gamma radiation from Zr^{95}, Cb^{95}, and Cb^{95m}, were investigated with the intermediate image beta spectrometer as well as with a crystal scintillation spectrometer (the Scintillation spectrometer of B. Åstrom). The half-life of the Cb^{95}-isomer was found to be 84±2 hours. The ft-values for the beta transitions and the internal conversion coefficients for the gamma radiations were determined. The decay scheme for Zr^{95} and Cb^{95} proposed by Levinger and the decay scheme for Cb^{95} suggested by Nedzel, were confirmed. The doubtful 920 keV gamma radiation observed by Nedzel in the decay of Zr^{95} was not found, but a 1070 keV gamma radiation was recorded. The half-life of the radiation was the same as for Zr^{95}, but the intensity compared with that of the 721 keV line was not the same in two samples irradiated at different times at Harwell. The 1070 keV gamma ray may therefore originate in some contamination. The experimental results agree with the supposition that the 721 keV level of Cb^{95} is a $g_{7/2}$- level.

829. SLYH, J. A., SCHOFIELD, H. Z., AND AUSTIN, C. R. Carbon or Graphite as a Liner for Combustion Chambers of Rocket Motors, Report No. 11. Battelle Mem. Inst., Nov. 15, 1946, 5 pp. M-3421.

Data are presented covering the application and fusion of thoria or thoria and zirconia films to tungsten carbide coatings on graphite specimens; data also are presented covering the resistance to oxidation of graphite coated with metallic aluminum or tantalum. Coatings of thoria or a mixture of thoria and zirconia over tungsten carbide-treated graphite carburized during sintering. The resultant carbides decomposed rapidly when exposed to the atmosphere. Coatings of aluminum and of tantalum on graphite failed to protect the graphite from oxidation when subjected to elevated temperatures. Both coatings deteriorated rapidly by oxidation of the metal, and melting and erosion of the oxide, when subjected to the torch firing test. Efforts to produce a coating of titanium carbide on graphite by reaction with titanium sulfate were unsuccessful.

830. _____. Refractory Oxides as Liners for Combustion Chambers of Rocket Motors. Battelle Mem. Inst., Oct. 15, 1946, 7 pp. M-3339.

Test specimens were made from various refractory metal oxides and were subjected to a special high-temperature flame test developed for this work. A body of zirconia stabilized with magnesia, and an equimolecular mixture of zirconia and thoria were the most refractory of those investigated; both withstood temperatures above 4,200° F. with negligible sintering and no spalling. The rate of temperature rise employed in these tests was 3,900° F. in 10 seconds and 4,200° F. in 30 seconds. Zirconia-strontia, chromium oxide, zirconia-barium oxide, zirconia-chromium oxide, and zirconia-lime specimens also were tested. The refractoriness of the respective bodies decreased in the order named. The zirconia-strontia body was only slightly less refractory than that of zirconia-thoria; the zirconia-lime mixture fused at 4,000° F.

831. _____. Refractory Oxides as Materials of Construction for Rocket Motors. Battelle Mem. Inst., Feb. 15, 1948, 13 pp. NP-519.

Data are presented on the testing at Wright Field, in a 25ALD1000 rocket motor, of two combustion-chamber liners made of magnesia. The results of torch firing tests on specimens made of stabilized zirconia or fine-grained magnesia are described and some of the physical properties of specimens made from metal-metal oxide bodies are presented.

832. SMITH, D. D., AND SPITZER, E. J Spectrographic Analysis for Hafnium in Zirconium Oxide. Oak Ridge Nat. Lab., Y-12 Area, Mar. 24, 1950, AECD-2924, 10 pp. decl. Oct. 2, 1950.

Generated on 2024-09-20 18:04 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

An analytical procedure for quantitatively determining the amount of hafnium present in zirconium oxide is presented. Uniform and reproducible burnings are attributed to an added buffer or barium fluoride and powdered graphite. The hafnium 2820 A line has been densitometered at a concentration of 65 p.p.m. The accuracy claimed for this method of analysis is 10 to 20 percent of the amount of hafnium present in the concentration range below 0.5 percent and above 0.01 percent.

833. SMITH, D. D., AND SPITZER, E. J. Analysis of Zirconium Oxide. Oak Ridge Nat. Lab., Y-12 Area, July 12, 1950, 9 pp. Decl. Oct. 4, 1950, AECD-2947.

A spectrochemical method is presented for the quantitative analysis of zirconium oxide for 22 impurities. Silver chloride is used as a carrier in a pyroelectric type of arcing procedure. One part per million of many impurities can be determined by visual comparison to an accuracy of ±50 percent of the element present.

834. SMITH, G. V. Sigma Phase in Stainless Steel, What, When, and Why. Iron Age, Part I, vol. 166, No. 22, Nov. 30, 1950, pp. 63-68; Part II, vol. 166, No. 23, Dec. 7, 1950, pp. 127-132.

Part I of this two-part article clarifies many of the misunderstandings concerning sigma phase, although not all of the mysteries of sigma, including its effect on properties, are fully understood as yet. The effect of sigma on mechanical properties is particularly important in applications involving long exposure to high temperatures. In these cases, properties of the metal change continuously. Sigma can be converted into harmless delta ferrite by heat treatment; however, this restoration method may produce grain growth.

835. SMITH, T. S., AND DAUNT, J. G. Some Properties of Superconductors Below 1° K., III, Zr, Hf, Cd, and Ti. Phys. Rev., vol. 88, No. 5, December 1952, pp. 1172-1176.

Using techniques for measuring the magnetic threshold curves of superconductors below 1° K. previously employed, investigations have been made on cadmium, zirconium, hafnium, and titanium, both before and after heat treatment. It was found that, in zirconium and hafnium, the magnetic superconducting properties were profoundly affected by heat treatment and that only after suitable annealing did these properties approach those of an ideal superconductor. The results for the annealed metals were as follows: The transition temperature, Tc, in zero magnetic field was 0.602° K. for cadmium, 0.546° K. for zirconium, 0.374° K. for hafnium, 0.558° K. for titanium and the slope of the magnetic threshold curves at T = Tc in gauss/degree was 112 for cadnium, 170 for zirconium, 230 for hafnium, and 450 for titanium. The magnetic threshold curves for cadmium and zirconium were parabolic with H_o = 33.8 gauss for cadmium and 46.4 gauss for zirconium. The thermodynamically computed specific heat of the normal electrons was $1.54 \times 10^{-4}T$ cal/mole-deg for cadmium and $3.92 \times 10^{-4}T$ mole-deg for zirconium. No thermodynamic computations were made for hafnium and titanium owing to the irreversibility of their superconducting transitions.

SMITHEY, I. W. See abs. 918.

836. SMOKE, E. H., AND KOENIG, J. H. Thermal Shock Behavior of Ceramic Dielectrics. Ceram. Age, vol. 57, No. 2, February 1951, pp. 17-19.

A comprehensive study directed toward the developing of ceramic dielectrics of high thermal shock resistance.

837. SMOKE, E. J. Low Loss Zircon Dielectrics. Ceram. Age, vol. 61, No. 2, February 1953, pp. 15-17.

A low loss zircon dielectric body has been developed that compares favorably to steatite, physically and electrically, and has superior thermal shock properties. Because of its raw batch composition,

Generated on 2024-09-20 18:06 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

which is low in zircon and high in clay, this body fabricates easily, particularly as compared to normal zircon bodies. The development of this body is discussed.

838. SMOKE, E. J. Thermally Resistant Whiteware. Jour. Am. Ceram. Soc., vol. 33, No. 5, May 1950, pp. 174-177.

Thermal endurance in the field zircon-calcium zirconium silicate-clay was evaluated together with those physical properties that should contribute most to this characteristic. The coefficient of thermal expansion was similar throughout the field, resulting in an area of high thermal endurance that coincided quite closely with that of high transverse strength. The best compositions did not fail until the 500° F. quenching cycle (one cycle at each temperature) and withstood 30 cycles from 400° F. Petrographic analysis revealed that good thermal endurance could be attained over a wide range of compositions.

839. SMOLENSKIY, G. A. /Piezoelectric Properties of Some Titanates and Zirconates of Bivalent Metals that Possess a Perovskite-Type Structure./ Jour. Tech. Phys. (U. S. S. R.), vol. 20, No. 2, 1950, pp. 137-147. NP-2296.

The dielectric permeability of some titanates and zirconates of bivalent metals that possess the structure of pervskite was investigated. It was found that cadmium titanate, lead titanate, and lead zirconate and also solid solutions $(Ca,Pb)TiO_3$ and $(Sr,Pb)TiO_3$ are piezoelectric. It was proved that the curie temperature of these piezoelectrics is most influenced by the degree of covalence of the lattice bond and by the dimensions of the oxygen octahedron, which contains a titanium ion. It was proved that piezoelectrics of this type have a tetragonal lattice below the curie point.

840. SMOTHERS, W. J. Effect of Alumina Hydrate Additions on Strength of Zircon Bodies. Ceram. Age. vol. 61, No. 5, May 1953, p. 13.

Zircon bodies with the composition zircon 64.7 percent, georgia kaolin 29.2 percent, and talc 6.1 percent were fired to cone 19 in 8 hours. The effect on hardness of the addition of alumina and aluminum hydrate was studied and plotted results are given.

841. SNYDER, M. J., BURKART, C. A., AND CLEGG, J. W. Investigation of Cementitious Materials for Possible Use in Concretes for Pile Shielding. Battelle Mem. BMI-T-21, Inst., September 1949, 21 pp.

The experimental program on concretes for pile shielding conducted at Battelle Memorial Institute has been concerned with the development of highly hydrated concretes of high density with acceptable mechanical properties.

842. SOMERVILLE, I. C., AND TURLEY, H. G. Zirconium Tannage III, Chrome-Zirconium Tannages. Jour. Am. Leather Chem. Assoc., vol. 38, 1943, pp. 326-332.

The study of the tanning action of zirconium salts has been extended to cover chrome-zirconium tannages. It has been found that zirconium can be substituted for part or all of the chrome to give leather of comparable quality to that made with a full chrome tannage. Zirconium can also be used as a retan to give additional weight to chrome leather. A cheaper product, Zircotan Tech., has been developed, which should enable zirconium to be considered as a practical substitute for chrome.

843. SOUTH AFRICAN MINING AND ENGINEERING JOURNAL. Hafnium in Tanganyika. Vol. 64, No. 1, June 20, 1953, p. 629.

There is in Tanganyika Territory a considerable deposit of orthite, which carries unusually high values in hafnium. No further information is given, although more details are available from the

Generated on 2024-09-20 18:11 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Mining Consultant, Dept. of Mines, Dar Es Salaam, Tanganyika.

844. SOUTH AFRICAN MINING AND ENGINEERING JOURNAL. Purification of Zirconium. Vol. 63, No. 3116, Nov. 1, 1952, p. 347.

A rapid, convenient method of freeing zirconium of common impurities, except hafnium, has been developed by W. S. Clabaugh and R. Gilchrist of the National Bureau of Standards.

SOWMAN, H. G. See abs. 146.

845. SOWMAN, H. G., AND ANDREWS, A. I. Quenching Furnace for High-Temperature Studies of Small Specimens. Jour. Am. Ceram. Soc., vol. 33, No. 12, December 1950, pp. 365-366.

Describes a high-temperature, quenching furnace for study of small specimens. A heavy tungsten wire coil is used as a heat source. The furnace can be operated in a vacuum or in reducing or neutral atmospheres. This quenching furnace has been applied successfully to temperatures as high as 2,300° C. in phase equilibrium studies of the systems ZrO_2-TiO_2 and ZrO_2-SiO_2.

846. _____. Study of the Phase Relations of ZrO_2-TiO_2-SiO_2. Jour. Am. Ceram. Soc., vol. 34, No. 10, October 1951, pp. 298-301.

The phase relations of the systems ZrO_2-TiO_2 and ZrO_2-TiO_2-SiO_2 were investigated. X-ray diffraction techniques served as the principal means of analysis. The binary system ZrO_2-TiO_2 was found to be one of partial solid solutions with no intermediate compounds. A eutectic point was found to exist at 50 to 55 weight-percent ZrO_2 and 1,600° C. A preliminary investigation of the ternary system ZrO_2-TiO_2-SiO_2, although not extensive, resulted in a better understanding of this system, with a fairly accurate location of some of its boundary lines. A eutectic point was located at 2 percent ZrO_2, 10 percent TiO_2, and 88 percent SiO_2 at approximately 1,500° C.

SPEAR, E. B. See abs. 662.

847. SPEICH, G. R., AND KULIN, S. A. Determination of Solid Solubilities by a Strain-Aging Technique. Westinghouse Atomic Power Div., June 1952, 17 pp. AECD-3425.

A strain-aging technique has been used to determine the solid solubility of Sn in Zr at comparatively low temperatures. This method may be applied to the determination of solid solubilities at low temperatures in other alloy systems. An optimum temperature range exists over which this method is applicable. This is a function of the alloy being investigated and must be determined experimentally in each case.

848. _____. Solid Solubility of Tin in Alpha Zirconium; chap. in Zirconium and Zirconium Alloys. Am. Soc. Metals, Cleveland, Ohio, 1953, pp. 197-207.

The solid solubility of tin in alpha zirconium has been determined at high temperatures by changes in lattice parameter and at low temperatures by a strain-aging technique. At elevated temperatures, the solubility is greater than previously metallographically established solubility limits, whereas at temperatures below 300° C. the solubility diminishes to very small values. The strain-aging technique employed involves observation of changes in yield stress of tensile specimens after aging at the test temperature. Both increase in yield stress and serrated stress-strain curves are observed at temperature ranges below the solubility limit, whereas smooth stress-strain curves result at temperatures within the solubility range. The limitations of this method for determination of low temperature solubilities are discussed.

849. SPEIGHT, G. E. Analysis of Non-Metallic Residues Extracted by the Alcoholic Iodine Method. Jour. Iron and Steel Inst. (London), May 1941, pp. 371-375.

Generated on 2024-09-20 18:06 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The improvements in the analysis of nonmetallic residues effected since the publication of the Second Report of the Oxygen Sub-Committee are given, and the progress towards complete colorimetric determination is indicated. Details of a colorimetric method for small quantities of alumina and a brief outline of the present complete scheme of analysis of nonmetallic residues are given.

850. SPINK, D. R., AND WILHELM, H. A. Caustic Treatment of Zircon in the Preparation of Pure Zirconium Compounds. Ames Lab., Iowa State College, ISC-217, March 1952, 55 pp. AECD-3534.

This investigation was conducted to develop a process whereby the most abundant zirconium ore, namely zircon, could economically be put into solution and purified adequately for use in hafnium separation processes employing liquid-liquid extraction. Secondary aims concerned the preparation of pure zirconyl chloride, zirconyl nitrate, zirconyl sulfate, and zirconium oxide from the zircon ore. Caustic soda was found to be a suitable agent for the decomposition of zircon sand (zirconium silicate). Using an optimum ratio of 1.1 parts, by weight, of caustic soda to one part of zircon sand, sodium zirconate and sodium silicate with small amounts of sodium silicorzirconate were formed after heating for 1 to 2 hours in a furnace set at an optimum temperature of about 650° C. The resulting product was a light-colored, granular material from which the water-soluble sodium silicate was easily removed in a hot-water-leaching operation. The water-insoluble zirconates were put into solution with hydrochloric acid. Zirconyl chloride was then crystallized from this solution to remove iron, titanium, some silica, and other soluble impurities. The crystalline zirconyl chloride was then separated from its mother liquor in such a manner as to give a very dry crystal. These crystals were then put into a water solution, which was clarified in order to remove silica. The resulting zirconyl chloride solution could be used directly to make feed material for the liquid-liquid extraction systems or processed further to give high-purity zirconium (or zirconyl) compounds such as the oxide, chloride, nitrate, and sulfate.

SPITZER, E. J. See abs. 832, 833.

851. SQUIRE, C. F. Abnormal Diamagnetism of Ge at Low Temperatures; the Specific Heat of Zr. Phys. Rev., vol. 58, 1940, p. 202.

An abstract of an article on work accomplished at the University of Pennsylvania on abnormal diamagnetism of Ge at low temperatures and on the specific heat of zirconium.

852. SQUIRE, C. F., AND KAUFMANN, A. R. Electron Configuration Change in Metallic Zr From Magnetic and Resistance Measurements. Phys. Rev., vol. 59, 1942, p. 690.

According to theory, the paramagnetic susceptibility of electrons in a metal should decrease slightly with increase of the temperature. For pure, ductile Zr, our experiments show that the paramagnetism increases with rising temperature from 80° up to 1,000° K. in a linear manner. Above this temperature the susceptibility rises in a nonlinear manner until at 1,120° K. it shows a λ point where the crystal is known to undergo a structure change. Above the λ point the paramagnetism shows normal temperature dependence. We account for these and the following data by supposing that the density of electrons at the top of the filled energy states is continuously increasing. The electrical resistance was found to rise with temperature so that dR/dT became smaller and approached zero as T approached the λ point. In accord with Zwikker the resistance then drops at the structure change and then rises linearly with temperature. As much as 1.36 mols of atomic hydrogen could be dissolved in a mol of Zr, increasing the volume about 8 percent, giving the specimen some unusual magnetic properties and lowering the transition temperature to 960° K.

Generated on 2024-09-20 18:01 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

853. SQUIRE, C. F., AND KAUFMANN, A. R. Magnetic Susceptibility of Ti and Zr. Jour. Chem. Phys., vol. 9, September 1941, pp. 673-682.

The paramagnetic susceptibilities of Ti and Zr have been found to increase linearly with increasing temperature from 20° K. until a crystal structure change occurs at high temperatures. Electrical conductivity, specific heat, and thermal expansion studies were made on Zr and the evidence indicates a change in the electron configuration.

STAGG, L. J. See abs. 158.

STAHLY, E. E. See abs. 131.

854. STANLEY, J. K., von HOENE, J., AND WIENER, G. Determination of Oxygen in Zirconium Metal by the Vacuum Fusion Method. Anal. Chem., vol. 23, No. 2, February 1951, pp. 377-379.

Some typical results and operating conditions are given. The results approximate the oxygen suspected in the samples prepared by deliberate additions of oxygen or by Lilliendahl's chlorine method. The oxygen determined by vacuum fusion is higher than that estimated by doping - that is, oxygen is added deliberately by oxidation and the weight increase is determined; this might be expected if the oxygen content of the starting material before doping is not accurately known. The agreement between the vacuum fusion method and the chlorine method is reasonably good.

855. STEEL. Heat and Corrosion Resistant Materials. Vol. 133, Oct. 12, 1953, pp. 173, 176, 179.

High-temperature resistance and corrosion resistance are important requirements for metals or materials to be used under extreme service conditions. A number of metals including zirconium are discussed from the standpoint of these requirements.

856. _____. More Zirconium Coming. Vol. 133, No. 14, Oct. 5, 1953, p. 97.

Zirconium rapidly is becoming available for use in chemical equipment as well as atomic energy installations. It possesses unusual corrosion resistance.

857. _____. More Zirconium Coming Up. Vol. 127, No. 4, July 24, 1950, pp. 63-64, 76.

Continued interest in and expanding demand for zirconium metal is resulting in improved methods for producing the metal in greater quantity. Within about 4 years, a Bureau of Mines process for reducing gaseous anhydrous zirconium chloride with magnesium under helium has developed from test tube to pilot plant producing regularly 300 pounds of metal per week.

858. _____. New Metals Gain in Importance. Vol. 129, No. 19, Nov. 5, 1951, pp. 116-117.

Titanium, zirconium, and molybdenum are being used for jet and rocket engines. Their uses are expanding rapidly because of special properties such as corrosion resistance, ductility, etc.

859. _____. Recent Developments in Rare Metals. Vol. 120, No. 14, Apr. 7, 1947, pp. 93, 94, 124, 126, 130, 133.

Advances in technology of thorium, uranium, and zirconium production are, for the most part, attributed to the development of metals of high purity, which are used for the preparation of these rarer elements and to simplification in equipment design rather than changes in basic methods. Highlights of modern development in methods of preparation, properties, and uses of the rare metals, zirconium, thorium, and uranium, are described.

STEELE, D. V. See abs. 779.

860. STEHNEY, A. F., AND SAFRANSKI, L. W. Determination of Zirconium. Argonne Nat. Lab., Oct. 19, 1944, 14 pp. Decl. Mar. 19, 1951. AECD-3097.

Generated on 2024-09-20 18:03 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The method of Hayes and Jones, which uses ρ-dimethylaminoazophenylarsonic acid to precipitate zirconium, was studied for the range of one to seven micrograms of zirconium. The most strongly interfering ions, namely phosphate, fluoride, sulfate, and the tetravalent cations of uranium, thorium, and plutonium, were studied. Two procedures are suggested.

STEIERMAN, B. L. See abs. 246.

861. STEIGER, G. Note on the Precipitation of Zirconium Phosphate. Jour. Washington Acad. Sci., vol. 8, No. 20, Dec. 4, 1918, pp. 637-639.

Gives the results of several tests performed in which zirconium phosphate was quantitatively precipitated. The object of the precipitation was the separation of zirconium from titanium, iron, and other metals in rock.

STEINBERG, D. See abs. 862.

STEINBERG, E. P. See abs. 73.

STEINBERG, M. A. See abs. 713, 813, 814, 815, 816, 817.

STEINBERG, M. A., SIBERT, M. E., RAYNES, B. C., AND WAINER, E. Extractive Metallurgy of Zirconium by the Electrolysis of Fused Salts, Final Report. See abs. 818.

862. STEINBERG, R. H., AND STEINBERG, D. Nitriding Ferroalloys, Part II. Metals and Alloys, vol. 20, 1944, p. 630.

Presents the results of nitriding the rest of the more or less well-known ferroalloys used in steel making, along with the nitriding of scale or ferrous oxide. (Part I gives the results of a temperature study of the mass nitriding of ferromanganese, ferrochromium, ferrosilicon, powdered iron, and electrolytic manganese.)

863. STEINITZ, R. Investigation of Boride Phases, Preliminary Results. Powder Met. Bull., vol. 6, No. 1, April 1951, pp. 54-56.

The preparation and properties of a number of borides have recently been described in the literature, and especially the diborides of the 4th and 5th group of the periodic system are now well known. These borides can be produced easily in graphite crucibles by taking stoichiometric amounts of the elements and heating them to suitable temperatures.

STEPHENS, W. W. See abs. 373, 738.

864. STEPHENS, W. W., AND GILBERT, H. L. Chlorination of Zirconium Oxide. Jour. Metals, vol. 4, July 1952, pp. 733-737.

Describes production of anhydrous zirconium tetrachloride by direct chlorination of a zirconium oxide-carbon mixture in a silica-brick-lined chlorinator. Theory and thermodynamics of reactions are discussed. A pilot-model chlorinator and full-scale production equipment are described, and operating data are included.

865. STEPHENS, W. W., GILBERT, H. L., AND BEALL, R. A. Consumable-Electrode Arc Melting of Zirconium Metal. Trans. Am. Soc. Metals, vol. 45, 1953, pp. 862-871.

A production-model, consumable-electrode arc-melting furnace for zirconium and its alloys has proved successful. Contamination experienced in other methods of melting is avoided by using a pressed electrode of zirconium metal. Metal recovery from 8-inch diameter, 200-pound rough ingots varies from 75 to 85 percent. Scalpings are reused in later runs.

866. STEPHENS, W. W., AND McLAIN, J. H. Ductile Zirconium. Chem. Eng., vol. 58, No. 3, March 1951, pp. 116-117.

Generated on 2024-09-20 18:11 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

A general discussion of Kroll process ductile zirconium.

867. STEWART, R. S., AND URBAN, S. F. Influence of Carbide-Forming Elements on Underbead Cracking of Low Alloy Steel. Trans. Am. Soc. Metals, vol. 42, 1950, pp. 653-665.

This paper presents results obtained from an investigation undertaken to determine the effect of the potent carbide-forming elements (titanium, zirconium, columbium, and vanadium) on the tendency of hardenable, low-alloy steels to crack under the weld bead during arc welding.

STOCKETT, S. J. See abs. 796.

868. STOTT, V. H., AND HILLIARD, A. Variation in the Structure of Zircon. Mineralogical Mag., vol. 27, 1946, pp. 198-203.

Various heat treatments were carried out on zircon of normal density and constitution and on related materials. X-ray analysis estimates were made of the proportions of zirconium silicate and zirconia in the crystalline part of the products. Structure is discussed and results of experiments given.

STRAIN, H. H. See abs. 768.

STRAUSS, J. See abs. 804.

869. STRIETER, F. P. Magnesium Casting Alloys Containing Zirconium. Metal Progress, vol. 63, No. 3, March 1953, pp. 75-82.

Zirconium-containing cast magnesium alloys are becoming increasingly more important in the magnesium industry. Three different alloy systems (Mg-Rare Earth Metals, Mg-Th and Mg-Zn) require the use of zirconium to obtain castability and mechanical properties satisfactory for commercial use. The primary function of the zirconium is to produce a fine as-cast grain size. Much of the property improvement that results from the zirconium addition occurs as a result of the grain refinement. Mg-Rare Earth Metals-Zr alloys are useful primarily because of their creep resistance at temperatures of 400° to 600° F. Mg-Th-Zr alloys are still in the experimental stage, but their utility will be based on the improved creep resistance which they possess over the rare earth metal alloys at 500° to 700° F. Mg-Zn-Zr alloys possess a good combination of elongation and yield strength at room temperature. This combination should make these alloys useful in limited applications when their castability is improved. Zirconium can be alloyed to magnesium from several different sources. Since metallic zirconium is not plentiful and also since its alloying rate is slow, salt reduction processes have been used for production operations. The use of a Mg-Zr hardener made by the magnesium reduction of $ZrCl_4$ is proving to be convenient and economical for production foundries.

See also abs. 769.

STRIPLIN, M. M., JR. See abs. 377.

870. SUN, KUAN-HAN. Scale of Acidity and Basicity in Glass. Glass Industry, vol. 29, February 1948, pp. 73, 74, 98.

Gives discussion and scale table of acidity and basicity of glass.

SUSANO, C. D. See abs. 581.

SUTTON, L. E. See abs. 545.

871. SUWA, S. Hyperfine Structure of the Spectra of Gadolinium and Zirconium. Phys. Rev., vol. 86, No. 1, Apr. 15, 1952, pp. 247-248.

The hyperfine structure of the gadolinium spectrum in the visible region was studied. A water-cooled hollow cathode discharge tube (the cathode contained gadolinium oxide) and a Fabry-Pérot etalon were used.

872. _____. /Hyperfine Structure of the Spectrum of Zr I and the Magnetic Moment of Zr^{91}./ Jour. Phys. Soc.

Generated on 2024-09-20 18:11 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Japan, vol. 8, No. 6, November-December 1953, pp. 734-739.

The h.f.s. of the spectrum of Zr I was investigated, natural zirconium sample being used; and in some lines the h.f.s. of Zr^{91} calculated from the measured splittings in the line λ 4687.80 ($4d35_8F_5$-$4d35_p5G_6$) and other lines is μ (Zr^{91}) = -1.3 ± 0.3nm.

SWAZY, E. F. See abs. 520.

SYKES, C. Alloys of Zirconium, II. See abs. 6.

See also abs. 5.

TAUB, J. M. See abs. 638.

873. TAYLOR, A., AND CARMICHAEL, N. Effect of Metallic Chlorides on the Growth of Tumor and Non-Tumor Tissue. University of Texas Pub. 5314, July 15, 1953, pp. 36-79.

The main objective of this study was not directly concerned with cancer chemotherapy. It was rather to discover differences in the reaction of neoplastic and embryonic tissues grown together and sharing a common blood stream, to a series of metals administered, in most instances, in the form of chlorides. A series of 33 metallic chlorides and 4 metallic nitrates were tested at various dosages for their effect on the growth and survival of chick embryos and the tumors and embryos of egg-bearing yolk sac implants of a mouse mammary adenocarcinoma. Results are recorded in table form and discussed for each metallic chloride including zirconium chloride.

TAYLOR, B. T. See abs. 190.

874. TAYLOR, D. P. Acid Corrosion Resistance of Tantalum, Columbium, Zirconium, and Titanium. Ind. Eng. Chem., vol. 42, April 1950, p. 639.

Tantalum, columbium, zirconium, and titanium were tested in a number of reagents, under identical conditions of solvent action, to determine their acid corrosion resistance. Corrosion rates show tantalum to be completely resistant to all solutions tested; columbium had a high resistance against all these solutions except hot concentrated hydrochloric and sulfuric acids; zirconium and titanium were the least resistant of the four metals.

TAYLOR, H. S. See abs. 211.

TAYLOR, J. L. See abs. 186.

875. TEMPLETON, D. H. Colorimetric Determinations of Zirconium With Alizarin. Argonne Nat. Lab., December 1944, 4 pp. Decl. Mar. 19, 1951. AECD-3091.

The use of alizarin (1,2-dihydroxyanthraquinone) as a colorimetric reagent for the determination of zirconium has been extensively investigated by Liebhafsky and Winslow. Their method has been used successfully in this laboratory and has been found to be rapid and accurate. The method depends on the formation of a lake by the dye and zirconium hydroxide. An acid solution containing the dye and zirconium is made basic with ammonia to produce the lake. Acidification with hydrochloric acid converts the excess dye back to the yellow acid form and destroys the lakes formed by most other metals. The colloidal solution is diluted with ethanol to stabilize the colloidal lake. The strong absorption band of the lake at 560 millimicrons, where the yellow dye transmits strongly, is used for the estimation of the zirconium. The procedure is described in detail.

See also abs. 75.

TERRY, G. See abs. 525.

876. THAMER, B. J., AND VOIGT, A. F. Zirconium Chloranilate Complexes. Jour. Am. Chem. Soc., vol. 73, No. 7, July 1951, pp. 3197-3202.

Spectrophotometric measurements at 25° in 1 to 2 M perchloric acid solutions of

Generated on 2024-09-20 18:55 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

ionic strength of 2 have shown the equilibria: $ZR(IV) + H_2Ch \rightleftharpoons Zr(IV)C^{++} + 2H^+$, $K_1 = (5.69 \pm 0.08) \times 10^{+5}$, $Zr(IV)Ch^{++} + H_2Ch \rightleftharpoons Zr(IV)Ch_2 + 2H^+$, $K_2 = 6000$, where Zr(IV) represents the zirconium monomer, H_2Ch undissociated chloranilic acid and the constants are in terms of concentrations. A precipitate that forms in these solutions with concentrations of the reactants of roughly 5×10^{-4} molar is shown to have a Zr:Ch ratio of 1 to 1.24. A spectrophotometric method is developed for determining zirconium at formalities of 2×10^{-6} to 5×10^{-5} using chloranilic acid and measurement at 3400 Å. The color reaction proceeds rapidly and yields a true solution that is stable indefinitely. The characteristics of chloranilic acid as a colorimetric reagent for zirconium are compared briefly with those of other such reagents.

THELLMAN, E. L. See abs. 713.

877. THEWLIS, J. Neutron Crystallography. Atomic Energy Research Est., England, AERE G/R 707, June 6, 1951, 15 pp.

Outlines the principles underlying the application of neutron diffraction to crystal analysis. A comparison with X-ray analysis is made, and the similarities and differences between the two are underlined. A short account of the experimental techniques involved is presented and a survey is made of crystallographic applications up to date. Future developments are then discussed.

878. THIELKE, N. R., AND JAMISON, H. W. Development of Zircon as a Versatile Ceramic Material. Bull. Am. Ceram. Soc., vol. 24, No. 12, 1945, pp. 452-456.

Presents a survey of the development and applications of zircon in modern ceramics. The distribution, mineral occurrences and commercial deposits are described, and mining and beneficiation methods are outlined. The physical and chamical properties of various commercial zircon products especially interesting to the ceramic engineer are tabulated, with particular reference to the application of zircon in the fields of refractories, enamels, glazes, and special porcelains.

879. THOMAS, A. W., AND OWENS, H. S. Basic Zirconium Chloride Hydrosols. Jour. Am. Chem. Soc., vol. 57, October, 1935, pp. 1825-1828.

The ρH values of basic zirconium chloride (so-called 'zirconium oxide') hydrosols are raised by adding potassium salts. The order of effectiveness in general similar to that found with other hydrosols is citrate > oxalate > malate > tartrate > glycolate > succinate = malonate = maleinate > propionate = acetate = fumarate = formate > sulfate > chloride = nitrate, the first named markedly increasing the ρH value whereas the last named exerted very slight effect. This effect is ascribed to displacement of coordinatively bound OH groups by the anion of the added salt, the anion then becoming coordinatively bound to zirconium atoms in the micelle. Dialyzed basic zirconium chloride sols become more acid upon standing at room temperature, although not so rapidly as basic thorium chloride sols. The decrease in ρH is hastened by heating and the reactions show no sign of reversal after 6 months of storage at 25°. In the latter respect, basic zirconium hydrosols differ from those of thorium. As in the cases of other basic metallisalt hydrosols, the heated sols are less responsive, in so far as ρH changes, to the action of added neutral salts. It may be said that zirconium oxide hydrosols show a very strong tendency to oxolate. By applying the ideas that Werner and Pfeiffer suggested for crystalloid basic salts, and assuming that the micelles in basic zirconium chloride hydrosols are polyolated and/or oxolated structures, their behaviors can be readily interpreted.

880. _____. Formation of Zirconate Hydrosols and Their Disintegration by Certain Neutral Salts. Jour. Am. Chem. Soc., vol. 57, November 1935, pp. 2131-2135

Generated on 2024-09-20 18:08 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Certain neutral salts convert basic zirconium (cationic) micelles to zirconate (anionic) micelles whereas others do not. Certain neutral salts disintegrate basic zirconium (zirconium oxide) micelles to the crystalloidal state. Zirconate hydrosols of low pH value may be formed by the action of certain acids upon hydrated zirconium oxide. The possibility of the coexistence of positively and negatively charged micelles has been demonstrated. The polyolation and oxolation theory of the structure of metallic oxide hydrosol micelles proposed by this laboratory renders possible the prediction and understanding of these behaviors.

881. THOMAS, C. L. Chemistry of Cracking Catalysts. Ind. Eng. Chem., vol. 41, January-December 1949, pp. 2564-2573.

The chemistry of both silica and alumina in the solid state has been applied to the silica-alumina cracking catalyst. This resulted in the hypothesis that the active part of the catalyst is formed when 1 aluminum atom shares 4 oxygen atoms, which in turn are shared by 4 silicon atoms. An acidic hydrogen ion is thought to be associated with the four oxygen atoms surrounding the aluminum atom. The catalytic activity is ascribed to this acidic hydrogen. The formula for the active part of the catalyst has been written $(HAlSiO_4)\chi$, where where χ indicates that it is a part of a solid that may have the same or a different composition. The nature of $(HAlSiO_4)\chi$ is such that it cannot exist as the monomer, $HAlSiO_4$. The logic built up in the hypothesis leads to the conclusion that for maximum activity, the catalyst should have a composition in which the atomic ratio of silica to alumina is one. To obtain maximum activity these catalysts should be made in special ways. Silica-alumina catalysts of maximum activity probably cannot be prepared by forming a silica hydrogel and depositing alumina on it.

882. THOMPSON, J. G. Electric-Furnace Purification of Zirkite. Trans. Am. Electrochem. Soc., vol. 40, 1921, pp. 445-455.

The purpose of this investigation was to determine to what extent the impurities might be removed from zirkite ore in the electric furnace. In the resistance-type furnace, the rate of power input was insufficient to attain the high temperature (above 2,220° C.) desired. In the arc type, 90-95 percent of silicon was removed from the ore; an amount of carbon added sufficient to transform only silicon to the carbide gave the best results. With excess carbon, a double carbide of silicon and zirconium probably forms, which requires further study.

883. THORBURN, R. C. Zirconium Analysis. Atomic Energy Comm., AECD-3451, Feb. 21, 1950, 5 pp.

Separation of zirconium from the urine salts by standard chemical methods was tried with poor results. A clean separation was obtained by precipitating zirconium in a strongly acid solution of the salts with phosphate ion. The zirconium is then dissolved by complexing with fluoride ion and the other acid insoluble salts are removed by centrifugation. The zirconium fluoride or zirconyl fluoride complex is then destroyed by adding an excess of boron, allowing the zirconium to be reprecipitated as the phosphate. After two of these cycles, the zirconium phosphate is ignited to the pyrophosphate and weighed as such. Acceptable yields were obtained; the method is rapid and adaptable to routine analyses.

884. THORNTON, W. M., JR., AND HAUBER, E. S. General Account of the Element Zirconium. Loyola College, undated, 5 pp.

A short account is given of the occurrence of zirconium in rocks and minerals. A literature survey is included.

885. TIGHE, J. J., GERDS, A. F., CENTER, E. J., AND MALLETT, M. W. Modified HCl Volatilization Method for

Generated on 2024-09-20 18:09 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Determining Oxygen in Zirconium. Battelle Mem. Inst., BMI-799, Dec. 29, 1952, 13 pp.

The method for determining oxygen in zirconium metal as described by Read and Zopatti has been modified to reduce the overall operating time and to facilitate handling of the metal halides in the equipment during the reaction. Results comparable with the original method have been obtained.

TOBIN, W. J. See abs. 641.

886. TODD, S. S. Heat Capacities at Low Temperatures and Entropies at 298.16° K. of Hafnium Dioxide and Hafnium Tetrachloride. Jour. Am. Chem. Soc., vol. 75, 1953, p. 3035.

Thermodynamic values of hafnium compounds have been lacking because of unavailability of adequately pure materials. Recently, substantially pure hafnium and some of its compounds have been produced in considerable amounts. This paper reports low-temperature heat capacity data and entropy values at 298.16° K. for hafnium dioxide and hafnium tetrachloride. No previous similar data exist for either substance.

887. _____. Heat Capacities at Low Temperatures and Entropies of Zirconium, Zirconium Nitride, and Zirconium Tetrachloride. Jour. Am. Chem. Soc., vol. 72, July 1950, pp. 2914-2915.

The present paper gives low-temperature heat-capacity values and entropies at 298.16° K. for the metal, nitride, and tetrachloride, thus making possible free-energy calculations for the last two substances. Low-temperature heat-capacity and entropy values for the oxide and silicate have been reported by Kelley.

888. TOMPKINS, E. R., KHYM, J. X., AND COHN, W. E. Ion-Exchange as a Separations Method, I, The Separation of Fission-Produced Radioisotopes, Including Individual Rare Earths, by Complexing Elution From Amberlite Resin. Jour. Am. Chem. Soc., vol. Jour. Am. Chem. Soc., vol. 69, November 1947, pp. 2769-2781.

Conditions have been described for the separation of cerium and yttrium by adsorption on Amberlite IR-1 columns and elution with 5 percent citric acid-ammonium citrate solutions. The separations were studied both for tracer and macro amounts, using radioactive isotopes of the elements to determine the degree of separation. The factors studied included concentration of eluant, ρH of eluant, the ratio of cerium and yttrium in the starting sample and length of columns. Conditions were established by which the elements, of spectrographic purity, were separated in macro quantities. The principles established for the separation of cerium and yttrium are being applied to develop methods for large-scale separation of adjacent rare earths; the details will be published in subsequent papers.

889. TOMPKINS, P. C., BROIDO, A., AND WISH, L. Methods of Analysis of Fission Products in the Experimental Biology Section. Argonne Nat. Lab., MDDC-616, Nov. 13, 1946, 13 pp.

This report describes methods used for radiochemical analysis of fission products most used in the Experimental Biology Section. The report includes methods of analysis of Sr^{89}, Ba^{140}-La^{140}, Zr^{95}-Cb^{95}, Ce^{144}-Pr^{144} and Y^{91} by standard chemical procedures. In addition, a method of analysis by use of an absorption curve is described in some detail for Zr^{95}-Cb^{95} mixtures. The absorption curve method makes possible rapid determination of percentage composition of a mixture of isotopes with a minimum of chemical manipulation by utilizing the differences in absorption characteristics of the emitted rays.

TORGESEN, J. L. See abs. 669.

890. TOURNAIRE, M. Effect of Zirconium on the Properties and Structure of Super-Duralumin, With Particular Reference to Forgings. Jour. Inst.

Generated on 2024-09-20 18:05 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Metals, vol. 80, 1951-1952, pp. 593-597.

Superduralumin A-U4 G1 (Duralumin FR) is frequently used in France for high strength forgings. However, these forgings, particularly those of large size, are susceptible to quenching cracks and in addition, like forgings in ordinary Duralumin, they show considerable variations in grain-size in different parts of the same section. In the course of researches aimed at rendering forged Superduralumin less liable to quenching cracks, it has been found that if the manganese content of the alloy is replaced wholly or partly by 0.25 percent zirconium (it is impossible to add more than 0.25 percent), forgings are obtained whose mechanical properties are in no way inferior but which have a remarkably fine and uniform grain-size. This advantage, valuable in itself, is not the only one resulting from the addition of zirconium, for the new alloy can be cast, by the semicontinuous method, into very large billets with less risk of fissures than with ordinary Superduralumin and it can be forged with greater ease.

891. TOUSSAINT, W. J., DUNN, J. T., AND JACKSON, D. R. Production of Butadiene From Alcohol. Ind. Eng. Chem., vol. 39, No. 3, February 1947, pp. 120-125.

The ethanol-acetaldehyde process was adopted since it seemed to offer the greatest and the most certain advantages under the rapid development imposed by the was emergency. The ethanolcrotonaldehyde process did not provide a higher production of butadiene per gallon of alcohol consumed, and it would have required a larger amount of equipment and a greater number of operating personnel. The present studies in the development of this process probably had their greatest value in indicating the right path to the successful development of the ethanolacetaldehyde process. The Lebedey type of operation might have matured into a slightly superior process in some respects, but it presented, a priori, the disadvantage of compromise in the choice of conditions for two distinct reactions: Dehydrogenation of ethanol and conversion of ethanol and acetaldehyde to butadiene; also the complications of a larger and more variable amount of byproduct butene seem certain in plant operation. The ethanol-acetaldehyde process fulfilled its mission in providing a large supply of butadiene in the shortest possible time from what was a surplus material at that time. Zirconia is mentioned as a substitute catalyst.

TRABIN, B. See abs. 350.

892. TRAPNELL, B. M. Activities of Evaporated Metal Films in Gas Chemisorption. Proc. Roy. Soc. (London), vol. 218A, No. 1135, July 23, 1953, pp. 566-577.

The interaction of N_2, H_2, Co, C_2H_4, C_2H_2, and O_2 with clean evaporated films of some 20 metals has been investigated between 0° and -183° C. The results are expressed as gas chemisorbed or gas not chemisorbed. O_2 chemisorption is universal among all the metals studied, with the single exception of Au. Chemisorption of N_2 and H_2 is limited to transition metals and alkaline earth metals and chemisorption of Co, C_2H_4, and C_2H_2 to these and to Al, Cu, and Au. O_2 chemisorption is believed to take place with formation of O^{2-} ions at the surface, with electron donation from the s and p bands of the metals. The inactivity of Au towards O_2 is, however, only partly understandable in terms of this mechanism. The remaining five gases are believed to form covalent bonds with the metal d bands in chemisorption; with Cu and Au it is suggested that d-s promotion takes place in the act of chemisorption to allow such covalence. Al is exceptional, and with the light metals, s and p band electrons may be active in chemisorption: A further exception is the interaction of K with C_2H_2. Some applications of these results to catalytic systems are discussed.

893. TRECO, R. M. Effect of Small Additions of Oxygen on Lattice

Generated on 2024-09-20 18:03 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Constants and Hardness of Zirconium. Jour. Metals, vol. 5, No. 2, February 1953, p. 344.

A series of oxygen alloys of high-purity zirconium crystal bar examined by X-ray diffraction showed a marked expansion of the hexagonal lattice with increasing oxygen. Precision lattice constants of this zirconium were as follows a_o = 3.22562 ± 0.00014 kX units; c_o = 5.13709 ± 0.00036 kX units. Extrapolated lattice parameter values were also obtained for oxygen-free zirconium. Oxygen is shown to be an active hardening agent in zirconium, occupying an interstitial position in solid solution. The effect of minor impurities on density was found to vary with the specific elements. X-ray density of oxygen-free, high-purity crystal bar was found to be 6.507 g. per cc. A comparison of purity and density of various types of zirconium is included.

894. TRECO, R. M. Some Properties of High-Purity Zirconium and Dilute Alloys With Oxygen. Massachusetts Inst. Technol., MIT-1056, Nov. 15, 1950, 39 pp.; AECD-3346, April 1951, 36 pp.

An investigation has been made of the physical and mechanical properties of dilute alloys of oxygen in high-purity zirconium. A marked strengthening effect was observed as a result of oxygen addition. Whereas the corrosion resistance was not impaired.

TURKEL, S. H. See abs. 803.

TURLEY, H. G. See abs. 842.

TUTTLE, M. See abs. 610.

895. TWELLS, R., AND LIN, C. C. Effect of the Replacement of Free Silica by Alumina and Zirconia in Electrical Porcelain. Jour. Am. Ceram. Soc., vol. 4, 1921, pp. 195-205.

Since it had been suggested that free silica may be detrimental to the mechanical and the dielectric strengths of electrical porcelain, a series of 16 batches was prepared in which various proportions of the free silica were replaced, weight for weight, by alumina, zirconia or combinations of both, and bars and disks, after burning at cone 8-1/2 to 9 or at cone 12, were tested for shrinkage, transverse strength, impact strength, heat resistance, absorption of moisture and dye penetration. The results show that resistance to sudden temperature changes can be greatly improved by substituting zirconia, that the danger of overburning can be greatly decreased by substituting alumina, and that the mechanical strengths can be increased by substituting either or both; but in the case of dielectric strength, no improvement was obtained by substituting for the free silica.

896. TYLECOTE, R. F. Review of Published Information on the Oxidation and Scaling of Copper and Copper-Base Alloys. Jour. Inst. Metals, vol. 18, November 1950, pp. 259-300.

Part I of the review describes methods used in experimental work on the oxidation of metals, including weighing, optical and electrolytic methods for measurement of oxidation rates and X-ray and electron-diffraction methods for the study of oxide-film structures. The rate of oxidation of copper and the structure of the films formed are considered in Part II. There is a reasonably good agreement on the oxidation rate temperature characteristic for copper, the logarithm of oxidation rate reciprocal of absolute temperature curve consisting of two straight lines of different slopes intersecting at about 600° C. In Part III are reviewed the influence of alloying elements on the oxidation of copper and some effects of variations in the oxidizing atmosphere. A comprehensive table incorporates references to all the work found dealing with the oxidation of copper-base alloys. Selective oxidation and subscale formation are included in this section, and modern theories on oxidation phenomena are discussed also. Part IV deals with the practical aspects of oxidation, with particular reference

Generated on 2024-09-20 18:08 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

to the adherence of troublesome scales. Little has been published about the scaling characteristics of copper and copper-base alloys at normal processing temperatures. Slight information is available on the effects of impurities in bright-annealing atmospheres.

TYREE, S. Y. See abs. 105.

TYREE, S. Y., JR. See abs. 432.

897. UDY, M. C., MANNING, G. K., AND EASTWOOD, L. W. Metallographic Examination of Beryllium Alloys. Metals Trans., vol. 185, October 1949, pp. 779-784.

Reasonably satisfactory metallographic techniques have been developed for beryllium and beryllium-rich alloys. The following phases have been identified: Carbide, nitride, aluminum rich, silicon rich, calcium rich, titanium rich, tin rich, iron rich, manganese rich, boron rich, molybdenum rich, uranium rich, magnesium rich, and zirconium rich. No second phase attributable to copper could be found in a 6 percent copper alloy. No phase attributable to oxygen or hydrogen has been found, but this does not preclude their presence in liquid or solid solutions.

898. UHLIG, H. H., AND BROUGHTON, D. B. Less Common Metals. Ind. Eng. Chem., vol. 41, No. 10, October 1949, pp. 2153-2154.

Corrosion resistance and other properties of several metals including zirconium are described. The literature for the past 10 years has been covered.

899. BROUGHTON, D. B. Less Common Metals. Ind. Eng. Chem., vol. 42, No. 10, October 1950, pp. 2023-2025.

The past year has been notable chiefly for the increasing volume of published information on methods of production, physical properties, and corrosion resistance of ductile titanium and its alloys. Although the metal is still available only in development quantities, its combination of desirable properties points to wide-spread use when large-scale lower cost production methods are developed. New data on the corrosion resistance of tantalum and its alloys and on ductile zirconium have appeared. In the field of noble metals little new information of industrial significance has been published.

900. YNTEMA, L. F., AND BEKEBREDE, W. R. Less Common Metals. Ind. Eng. Chem., vol. 44, No. 10, October 1952, pp. 2364-2370.

The use of a less common metal as a material of construction is suggested by a unique property or combination of properties, such as workability or resistance to chemical attack. The noble metals and tantalum have retained their positions of importance in the chemical industries because of characteristics that fit them for many applications. The continued interest in titanium, based on its low density and high strength, is reflected in the stress being laid on the economics of its reduction. Information has been accumulated on the properties of its alloys and on the working and fabrication of both alloys and the pure metal. In the case of zirconium the importance of purification is indicated by the publication of data on the effects of small amounts of oxygen, nitrogen, carbon, and hafnium on its corrosion resistance and in the investigations directed toward improving melting techniques used in its production. The molybdenum literature is concerned with its use and properties at high temperatures. Protection against oxidation is described. Data have been published on alloy systems. The literature on the noble metals discusses their use in the chemical industries, their physical and chemical properties, and a series of alloy systems.

901. BEKEBREDE, W. R., AND YNTEMA, L. F. Less Common Metals. Ind. Eng. Chem., vol. 45, No. 10, October 1953, pp. 2261-2269.

The problems associated with working and fabricating titanium and its alloys

Generated on 2024-09-20 18:02 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

were investigated, and more information was accumulated on their chemical and galvanic corrosion behavior. The zirconium literature was concerned with its corrosion resistance, welding techniques, and alloy systems. The improvement of the high-temperature strength of zirconium by alloying was investigated. Information was published on the protection of molybdenum from oxidation and on its resistance to corrosion in hydrogen sulfide, sulfur dioxide, bromine, and iodine. Welding studies and properties of alloys were reported. The literature on tantalum discussed corrosion rates and alloy systems.

902. UNIVERSITY OF CHICAGO. Tenth Quarterly Report to ONR on Deformation of Metals. NP-798, June 14, 1949, 81 pp.

An attempt at interpreting observed staircase-like stress-strain curves in aluminum alloys has led to the concept of the initiation of new slip bands by previously formed slip bands and has thereby led to the viewpoint that plastic deformation must, under a wide range of conditions, be regarded as a cooperative effort between grains, rather than that each grain deforms at a rate determined solely by the overall stress. Stress-induced twinning may be regarded as taking place by a homogeneous shear strain. Such observations have led to the commonly accepted viewpoint that diffusionless phase transformations likewise take place by a homogeneous shear strain. This widely held viewpoint is questioned in the present report and an alternative theory is presented based upon the concept of dislocations forming a spearhead for the advancing new phase. The essentially viscous-like behavior of grain boundaries has been demonstrated in a series of papers included in former reports. The present report contains a continuation of this series. It is shown that very small overall concentrations of certain impurity atoms block grain boundary slip. The relation between stress and strain is usually regarded as linear within the elastic range. However, highly localized strains, such as induced by foreign atoms may be so high as to give rise to considerable deviation from a linear relation between stress and strain. Some consequences of these deviations are discussed.

903. _____. University of Chicago Toxicity Laboratory Quarterly Progress Report No. 1 on Radiobiology. M-4438, Apr. 12, 1949, 86 pp.

This report discusses the following subjects: Small exposure chamber for external gamma radiation studies on mice; the effects of gamma radiation on enzymatic reactions; toxicity studies on zirconium, tantalum, columbium, strontium, and lanthanum; an apparatus for injection of radioactive materials; a room remodelled to house radioactive animals; studies on the mechanism of beryllium poisoning; some effects on external gamma-radiation on animals; hydrogen peroxide is possible intermediate causative agent in radiation sickness; effect of l-radiation on the response of animals to drugs influencing the autonomic nervous system; effects of the antihistaminic drugs upon radiosensitivity; studies on radiosensitivity.

904. _____. University of Chicago Toxicity Laboratory Quarterly Progress Report No. 2 on Radiobiology. M-4339, July 15, 1949, 86 pp.

This report covers discussions on toxicity studies on zirconium, columbium, strontium, lanthanum, cesium, tantalum, and yttrium; inhibitory action of beryllium on phosphatases; effect of gamma radiation on phosphorus distribution in rabbit bone marrow; toxicity to animals of continuous external gamma-irradiation; a point source chamber for exposure of animals to gamma rays; hydrogen peroxide as possible intermediate causative agent in radiation damage, pathology, and toxicity; tissue peroxide and tissue catalase; influence of exposure to X-rays on the subsequent susceptibility of mice to the toxicity of histamine; effect of beryllium chloride on the blood pressure of the rat; effect of X-radiation on blood pressure in rats; effect of

Generated on 2024-09-20 18:10 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

dramamine upon radiosensitivity.

905. UNIVERSITY OF MINNESOTA. Use of Zirconium and Its Compounds as a Radiopaque Medium. 1950, 26 pp. AECU-1279.

Barium, iodine, lead and zirconium were compared as radioactive opaques for possible application to the treatment of brain tumors. Many zirconium compounds were investigated and none found nontoxic enough for human use when introduced intravenously. The great vessels and the kidneys of rabbits were shown clearly by sodium zirconyl citrate introduced intravenously. Zirconium oxide suspended in methyl cellulose was used for gastrointestinal study of dogs and a few humans. The advantages of zirconium over barium as an X-ray medium are discussed.

906. UNIVERSITY OF WISCONSIN. Chemistry of Zirconium and Hafnium, Fourth Quarterly Report, November 1, 1950 - January 31, 1951. March 1952, 15 pp. NP-3584.

Studies were made on addition compounds of zirconium and hafnium tetrachloride with phosphorus oxyhalogens, the behavior of zirconium and hafnium on ion exchange resins preparations and properties of the zirconium and hafnium derivatives of certain β-diketones and analytical studies of zirconium-hafnium samples.

UPTON, A. M. See abs. 304.

URBAN, S. F. See abs. 867.

UTTER, M. G. See abs. 754.

VALILOS, T. See abs. 657.

VANDALEN, E. See abs. 304.

VANDERGRIFT, R. B. See abs. 92.

907. van EWYK, L. J. How to Handle Magnesium-Zirconium Casting Alloys. Modern Metals, vol. 7, No. 3, April 1951, pp. 48-49.

How to handle magnesium-zirconium alloys from the standpoint of fabrication, foundry techniques, melting, and pouring is the basis of this report. One attractive feature of zirconium alloys is that the melt can be checked easily and effectively before the casting is poured. The importance of fluxes in the proper handling of magnesium casting alloys is discussed.

908. van GINNEKEN, A. J. J., AND BURGERS, W. G. /Habit Plane of the Zirconium Transformation./ Acta Cryst., vol. 5, July 1952, pp. 548-549.

In connection with an investigation by Bowles (1951) concerning habit plane of the β-X lithium transformation, an analogous investigation has been carried out on the habit plane of the zirconium transformation.

909. van GORDON, D. V. High-Fire Opaque Glazes for Zircon Bodies. Jour. Am. Ceram. Soc., vol. 34, No. 2, February 1951, pp. 33-38.

This investigation covers two systematic studies of raw, one-fire, zirconium-opacified glazes applied to two bodies of approximately 60 percent zircon content and fired to cones 11, 12, and 14. Throughout the range of firing the glazes high in magnesium oxide maintained the best texture; the barium oxide glazes had the best glass. The suitability of the better glazes developed in the investigation for bodies of very high zircon content was established by supplementary tests on four additional bodies containing from 72 to 90 percent zircon.

910. van LIEMPT, J. A. Hafnium Oxide in Tungsten Filaments. Nature, vol. 115, No. 2884, Feb. 7, 1925, p. 194.

Hafnium oxide is distinguished by its high melting point and its low vapor pressure at high temperatures, so that it has proved to be a suitable addition to tungsten for filaments.

Generated on 2024-09-20 18:04 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

van LIGTEN, J. W. See abs. 911.

van MATER, H. L. See abs. 378.

911. van NIERWENBURG, C. J., AND van LIGTEN, J. W. /Microscopic Distinction of Zirconium and Hafnium./ Anal. Chim. Acta, vol. 7, 1952, pp. 390-392.

A method has been worked out for the microscopic distinction of zirconium and hafnium by means of the reagent of Martini, quinoline, and ammonium thiocyanate. When using this reaction exactly as described by Martini there generally is a difference in the shape of the primarily formed crystals. When using 25 percent formic acid as a solvent instead of HClI: 2, hafnium always gives a good reaction, whereas the zirconium reaction is prevented.

van NUIS, E. L. See abs. 203.

912. van RYSSELBERGHE, P. Progress Report on Electrochemical and Polarographic Studies on the Corrosion of Zirconium in Presence of Various Aqueous Media. University of Oregon, Jan. 23, 1953, 3 pp. AECU-2385.

This report reviews the progress made on the polarographic and electrochemical investigations of zirconium being conducted at the University of Oregon.

913. ADAMS, G. B., JR., MARAGHINI, M., AND van RYSSELBERGHE, P. Electrochemical and Polarographic Studies on the Corrosion of Zirconium in Presence of Various Aqueous Media, Progress Report. University of Oregon, June 12, 1953, 9 pp. AECU-2592.

Studies were conducted on the anodic polarization of zirconium and its alloys and the polarography of the zirconium oxalate complex ion.

van RYSSELBERGHE, P. See abs. 566, 913.

VANSELOW, C. H. See abs. 298.

VARGA, J., JR. See abs. 56.

VEENSTRA, W. A. See abs. 449.

914. VEGARD, L. Results of Crystal Analysis. Phil. Mag., vol. 32, No. 187, July 1916, pp. 65-96.

The lattice of gold and lead has been determined and found identical with that of copper and silver. The structure of the zircon group has been completely determined. The Si as well as the Zr atoms are arranged in tetragonal lattices of the diamond type. In the case when Si and Zr are replaced by identical atoms Ti or Sn, a simple prism-centered lattice for the metallic atoms is noted. The tetragonal structure is not produced by symmetry properties of the atomic centers, but by the tetragonal arrangement of the oxygen atoms The lattice has a sort of molecular structure with molecules of the type MO_2, where M is an atom of Si, Zr, Ti, or Sn. The three atoms forming one molecule are situated on a straight line and with M in a central position. This line might be called the molecular axis. The positions of the oxygen atoms are determined, when the directions of the molecular axes are known and the distance to the central atom M (molecular distance). The fact that the molecular distance is different for different central atoms M, as also certain geometrical relations of the zircon lattice, goes to support the view that the group MO_2 form chemically bound molecules. For all the minerals considered, the molecular axes are equally arranged and are always perpendicular to the tetragonal axis, which accounts for the fact that the ratio c/a is smaller than unity and almost equal for all minerals. The 'metamict' crystal of thorite gave no X-ray reflexion. The lattice is completely destroyed. Experiments on the intensities of the normal spectrum have shown that different faces of the same crystal give a different law of the variation of intensities with increasing order.

Generated on 2024-09-20 18:01 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

915. VENABLE, F. P. Industrial Applications of Zirconium and Its Compounds. Jour. Elisha Mitchell Sci. Soc., vol. 34, No. 4, March 1919, pp. 157-162.

Gives uses of zirconium and its compounds.

916. VENABLE, F. P., AND BELL, J. M. Atomic Weight of Zirconium. Jour. Am. Chem. Soc., vol. 39, 1917, pp. 1598-1608.

Covers the purification of zirconium chloride, apparatus, determinations, density, and also the determination of chlorine. Further discussion of this work appeared in the Jour. Am. Chem. Soc., vol. 46, August 1924, pp. 1833-1834. This discussion is appended to the original article.

917. VENABLE, F. P., AND JACKSON, D. H. Hydrolysis of Zirconyl Chloride and Sulfate at Zero and Twenty Degrees. Jour. Am. Chem. Soc., vol. 42, September 1920, pp. 2531-2534.

The hydrolysis of zirconyl sulfate and chloride has been examined both by relative conductivity and by a precipitation method. The temperature were 0° and 20°, respectively. Three different dilutions were used, and the effect of the time factor was noted. There appears to be an initial temperature adjustment on dissolving the salts. Afterwards there is a decrease in the resistance until after about 3 hours an equilibrium or period of very slow change is reached. In the experiments with iodic acid there is also indication of an initial adjustment. The extent of the hydrolysis is indicated. The equilibrium or period of slow change is reached in 2 to 3 hours.

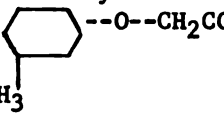
918. VENABLE, F. P., AND SMITHEY, I. W. Zirconyl Compounds With the Oxyhalogen Acids. Jour. Am. Chem. Soc., vol. 41, 1919, pp. 1722-1727.

Several basic zirconyl iodates were prepared and the stages of progressive hydrolysis indicated. The perchlorate $_4ZrO(ClO_4)_2.ClO_4H$ was obtained. This can be dissolved and recrystallized without further hydrolysis. Two molecules of it when warmed will dissolve two molecules of zirconyl hydroxide, forming $ZrO(OH)_2 \cdot {}_9ZrO(ClO_4)_2$, which is also crystalline. On redissolving and crystallizing the acid perchlorate or zirconyl perchloric acid separates. The basic zirconyl chlorate formed is crystalline and corresponds to the formula $ZrO(OH)_2 \cdot {}_3ZrO(ClO_3)_2$. It is easily decomposed.

919. VENKATARAMANIAH, M., AND RAO, S. V. R. Estimation and Separation of Zirconium by Use of Fumaric Acid. Analyst, vol. 76, February 1951, pp. 107-109.

Fumaric acid precipitates zirconium completely from solutions up to 0.35 N in hydrochloric acid. The precipitate, which has the approximate composition O = Zr = X (where X stands for the fumurate radical), is gelatinous; it is ignited to give the oxide. From solutions 0.25N in hydrochloric acid, the reagent separates zirconium from aluminum, beryllium, uranium, nickel, barium, calcium, iron, manganese, thorium, and the ceria earths in a single precipitation; vanadium, chromium, titanium and tin are completely removed in a double precipitation. Zirconium has also been estimated in zircon.

920. _____. m-Cresoxyacetic Acid, a Selective Reagent for Zirconium. Anal. Chem., vol. 23, March 1951, pp. 539-540.

Reagents for the determination of zirconium are many, but few are selective. The best known is mandelic acid, recommended by Kumins. To this may be added m-cresoxyacetic acid  , a reagent that is easily prepared and purified. From solutions 0.20 to 0.25 N in hydrochloric acid, zirconium can be

Generated on 2024-09-20 18:09 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

precipitated quantitatively in the presence of a number of elements, including thorium. This paper describes the use of this reagent for the selective precipitation of zirconium. The precipitate is voluminous and settles down quickly. As little as 2 mg. of zirconium oxide gives a precipitate large enough for convenient handling.

921. VERWEY, E. J. Electrical Double Layer of Oxidic Substances Especially in Non-Aqueous Media. Rec. trav. chim., vol. 60, 1941, pp. 625-633.

The electrical double layer at the surface of particles of oxidic substances (such as quartz, rutile, zirconium oxide) is studied: (1) By means of observations with suspensions of these substances in water, alcohols, acetone, or solutions of electrolytes in these liquids, and (2) by means of electroendosmosis through membranes in these liquids. The double layer is caused by ions originating from the materials involved. H^+ and OH^- are potential-determining. The zero point of the charge depends closely on the particle size: As in the case of AgI (Kruyt and Julien), large particles are more negative than smaller particles.

922. VIGERS, T. W. Magnesium Production and Fabrication. Metal Ind. (London), vol. 69, Aug. 2, 1946, pp. 91-93.

This is an extract from an original report on the production and fabrication of magnesium alloys at I. G. Farbenindustrie, Bitterfeld and Aken. This summarization covers the extraction of the metal from the ore, discovery and production of new alloys, fabrication and protection of magnesium alloys, and uses.

923. VOIGT, A. F. Progress Report in Radiochemistry, May 1, 1949, to October 31, 1949. Ames Lab., Iowa State College, ISC-78, Apr. 1, 1950, 14 pp.

This report covers studies on the separation of zirconium and hafnium; complex organic compounds of zirconium; extraction of ruthenium; radioactivities of gadolinium; ion exchange column studies; coincidence measurements; separation methods for radioactive germanium; impurity in radiophosphorus.

VOIGT, A. F. See abs. 162, 876.

924. VOLKERT, G. /Experiments on the Metallurgy of Zirconium Alloys./ Metall und Erz, vol. 40, 1943, pp. 246-252.

Presents experiments on the production of zirconium alloys: (1) By reduction with carbon, (2) reduction with silicon. Evaluation of results and a comparison of the reduction potentialities of the participants of reactions from their heats of combustion are given.

VONDRA, B. L., JR. See abs. 216.

von HOENE, J. See abs. 854.

925. VOSS, F. S. Modified Method of Radiochemical Activity Analysis. Carbide and Carbon Chem. Corp., Feb. 13, 1951, 15 pp. AECD-3132.

A modification of existing methods of radiochemical activity analysis has been developed. This modification makes more rapid analysis possible when a large number of somewhat similar activity analyses are required. A correction factor, which corrects for the loss in chemical yield, is determined once for each procedure and is used for all similar analyses, instead of a gravimetrically determined factor for each analysis.

VRIES, T. De. See De Vries, T.

926. VULCAN. Hafnium and Zirconium. Australian Foundry, vol. 4, No. 7, March 1953, p. 15.

This is a news item covering the present status of zirconium and hafnium.

Generated on 2024-09-20 18:11 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

927. WACHTELL, R. Method for the Metallographic Preparation of Zirconium Boride. Powder Met. Bull., vol. 6, No. 1, April 1951, pp. 62-66.

Preparation of specimens of zirconium boride for metallographic examination is difficult, if not impossible, by conventional means. Due to the strong tendency of the material to flake and chip, it has not proved practical to prepare polished surfaces even by using diamond compounds for abrasion, although these latter materials are surely hard enough to polish borides in the usual sense of the word.

928. WACKER, R. E., AND BALDWIN, W. H. Separation of Zr and Nb Oxalato Complexes by Anionic Exchange. Carbide and Carbon Chem. Corp., Mar. 23, 1951, 6 pp. ORNL-637.

Radioactive zirconium was used to study the separation of zirconium from columbium (niobium) by adsorbing them on Dowex-1 resin from oxalic acid solutions. They could be preferentially eluted (zirconium being eluted first) by elution with a solution of 0.01 molar oxalic acid in molar hydrochloric acid. The fractions were identified by radiochemical techniques, adsorption curves and decay curves.

929. WAGGAMAN, W. H., AND GEE, E. A. Titanium and Zirconium Metals of Industrial Promise. Chem. Eng. News, vol. 26, No. 6, Feb. 9, 1948, pp. 377-381.

Although considerable success has been attained in producing pure titanium and zirconium, the processes so far employed must be improved and simplified before these metals can be made available at a price low enough to admit of their wide industrial use for many purposes. There is no question, however, that they have physical properties of such value that their manufacture on a limited scale is well warranted even at present costs. The work on these metals and their alloys is still in the development stage, but is being actively pushed with a view to evolving more economical and practicable methods of manufacture. As the cost of producing pure titanium and zirconium is lowered, additional and expanded uses will be found that will call for large installations and the eventual establishment of new and substantial industries.

WAGNER, F. C. See abs. 816, 817.

WAINER, E. See abs. 713, 818.

WALLACE, R. H. See abs. 930.

930. WALLACE, W. P., AND WALLACE, R. H. Endurance Limit of Crystal Bar Zirconium. Livermore Res. Lab., California Research and Develop. Co., LRL-58, September 1953, 12 pp.

Fatigue tests on crystal-bar zirconium were performed utilizing rotating beam specimens, contilever loaded. The results indicate that this metal does not have a clearly defined endurance limit. The stress for fracture at 101 x 106 cycles was determined to be 16,000 p.s.i. Tensile and hardness properties and microstructure of zirconium tested are reported herein.

WARDLAW, W. See abs. 67, 68, 69, 70.

931. WARF, J. C. Extraction of Cerium (IV) Nitrate by Butyl Phosphate. Ames Lab., Iowa State College, Aug. 7, 1947, 10 pp. AECD-2524.

Cerium (IV) nitrate is readily extracted from aqueous solutions by tri-n-butyl phosphate, a solvent that is reasonably stable under the strongly oxidizing conditions. The conditions for extraction are not critical and favorable extraction is not inhibited by perchlorates or acetates but sulfates interfere. By oxidation with bromates and simultaneous exhaustive extraction by butyl phosphate, the cerium may be quantitatively extracted. The degree of separation of cerium from iron, zirconium lanthanum, and praseodymium are discussed. Uranium and thorium are extracted by

Generated on 2024-09-20 18:10 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

butyl phosphate; the first is easily removed beforehand, and the second may be separated by coprecipitation of ceric iodate. It is believed that cerium (IV) nitrate is extracted by butyl phosphate by virtue of the formation of a new complex. Some attempts were made to identify or characterize this new body, but no conclusive evidence was gained.

932. WARING, C. L., AND MELA, H., JR. Determination of Small Amounts of Rare Earths in Phosphate Rocks. Geol. Survey, June 1952, 20 pp. TEI-239.

Rare earths and thorium in phosphate rock samples are determined by a combined chemical and spectrographic method. After the removal of iron by the extraction of the chloride with ether, the rare earths and thorium are concentrated by double oxalate precipitation, using calcium as a carrier. The rare earths are freed from calcium by an ammonium hydroxide precipitation with a fixed amount of aluminum as a carrier. The aluminum also serves as an internal standard in the final spectrographic analysis. The method will determine from 0.02 mg. to 2 mg. of each rare earth with an error no greater than 10 percent.

WARNER, J. C. See abs. 625, 626, 627, 628, 629, 630.

933. WASHBURN, E. W., AND LIEMAN, E. E. Approximate Determination of the Melting-Point Diagram of the System Zirconia-Silica. Jour. Am. Ceram. Soc., vol. 3, 1920, pp. 634-640.

The melting point of pure ZrO_2 is about 2,700° C. The melting point of the natural mineral zircon is about 2,550° C. A mixture of ZrO_2 and SiO_2 in molecular proportions melts at the same temperature as the natural mineral. A eutectic between ZrO_2 and $ZrSiO_4$ occurs in the neighborhood of 2,300° C. Iron may be completely removed from zirconia by heating it to 300° C. in a current of phosgene.

934. WATERS, D. E., AND HUME, D. N. Comparison of Oxalate and Fluoride Methods for Determination of Zirconium Activity in Fission; chap. in Radiochem. Studies: The Fission Products, Nat. Nuclear Energy Series. McGraw-Hill Book Co., Inc., book 3, vol. 6, New York, N. Y., 1951, pp. 1507-1509.

A comparison is made of the radiochemical yield obtained by the oxalate and fluoride methods for determining zirconium activity in fission. The oxalate method is shown to give much lower yields than the fluoride method, which is quantitative.

WEAVER, B. See abs. 469, 470.

WEAVER, B. S. See abs. 953.

935. WEBB, G. M., AND EHRHARDT, C. H. Properties of Cracking Catalysts. Petrol. Processing, January 1947, pp. 5-8.

Knowledge of the properties of solid catalysts is necessary to refiners for efficient operation of their catalytic cracking units. Detailed accurate data on catalyst life under various operating conditions, catalyst structure, surface area, mechanical strength, heat stability, and so on will greatly aid in selecting types of catalysts best suited for individual plant operations. Much information on the subject has been developed in the research laboratories of Universal Oil Products Co. in the course of studies to improve cracking catalysts. This data is now being made available by UOP to refiners generally through Petroleum Processing. In this article, the three basic types of available cracking catalysts are listed and their properties described in a general way. Procedures are presented by which some important characteristics are determined, as, for example, the amorphous structure of synthetic silica-alumina catalysts. Later articles to be presented will discuss detailed data on the variable properties of catalysts used in commercial cracking operations, including the silica-zirconia catalyst.

Generated on 2024-09-20 18:06 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

WEICHEL, E. C., JR. See abs. 102.

WEISSKOPF, V. F. See abs. 213.

936. WELDING AND METAL FABRICATION. Zirconium and Titanium. Vol. 21, No. 1, January 1953, p. 1.

A news item on the current interest being shown in the use of zirconium, which has reasonable corrosion resistance, good mechanical properties, and also a low neutron absorbing capacity. This metal, which can be satisfactorily welded, is likely to be employed in the building of atomic reactors and power plants utilizing nuclear energy.

937. WELDING JOURNAL. New Metals - Molybdenum, Titanium, and Zirconium. April 1950, pp. 321-322.

A discussion of the new metals molybdenum, titanium, and zirconium, from the standpoint of properties and applications.

WELLING, C. E. See abs. 131.

938. WELLS, R. C. Solubility of Some Rare-Earth Nitrates in Ether. Jour. Wash. Acad. Sci., vol. 20, No. 8, Apr. 19, 1930, pp. 146-148.

A short discussion is given of the solubility of some rare earth nitrates in ether. Treatment with ether appears to have some limitations in removing the rare earths from uranium. It appears best to use oxalic acid, but avoid ammonium oxalate, as ammonium oxalate is probably the cause of the appearance of thorium with uranium. However, its use for separation of other rare earths seems possible.

939. WENGERT, G. B. Photometric Determination of Zirconium in Magnesium Alloys. Anal. Chem., vol. 24, No. 9, September 1952, pp. 1449-1451.

The development of a new system of magnesium-base alloys containing small amounts of zirconium led to the search for a faster and more accurate method for determining zirconium. The photometric alizarin red S method has been developed and found to give accuracy equal to or better than the gravimetric procedures. This has been applied to the analysis of a variety of magnesium alloys with zirconium contents ranging from 0.10 to 1.00 percent. A significant amount of time has been saved.

WERNER, S. See abs. 347.

940. WERNIMONT, G., AND DeVRIES, T. Determination of the Zirconium-Hafnium Ratio. Jour. Am. Chem. Soc., vol. 57, December 1935, pp. 2386-2387.

The optical rotation of solutions containing potassium tartrate along with various amounts of zirconium or hafnium oxychloride has been studied by de Boer and Emmens. They found that the effect of zirconium was somewhat less than that of hafnium and suggested that the polariscope might be used for determining zirconium-hafnium ratios. This paper describes such a procedure in which the fluorides were used.

WEST, G. H. See abs. 76.

WEST, W. See abs. 478.

WEYL, W. A. See abs. 452.

WHITE, C. E. See abs. 3.

WHITE, H. E. See abs. 251.

941. WHITE, J. R., AND CAMERON, A. E. Natural Abundance of Isotopes of Stable Elements. Phys. Rev., 2d Series, vol. 74, No. 9, Nov. 1, 1948, pp. 991-1000.

The natural isotopic abundances of the following elements have been determined by mass spectrometric techniques: Lithium, magnesium, silicon, potassium, calcium, chromium, iron, nickel, copper, selenium, bromine, strontium, zirconium, silver, cadnium, indium, tin, antimony, tellurium, tantalum, tungsten, rhenium, thallium, lead. Different masses were

Generated on 2024-09-20 18:03 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

focused by variation of the magnetic flux in Nier-type, 60° mass spectrometers. Ion currents were measured potentiometrically. Each measurement represents at least 15 determinations. Many measurements are averages of series with different spectrometers and ion sources. From available packing fraction data and these abundances the chemical atomic weights have been computed.

WHITE, M. R. See abs. 786.

942. WHITTEMORE, O. J., JR. Preparation of Small Dense Thoria Crucibles. Massachusetts Inst. Technol., December 1945, 5 pp. AECD-2187.

Describes a method for making small dense thoria crucibles, using 2 percent zirconia as a flux. Crucibles are pressed from a composition containing a water-soluble wax used as an internal body lubricant. The wax is then burned out and the crucibles fired to 1,800° C. The importance of the original properties of the raw material in regard to the ease of producing crucibles is discussed.

943. _____. Properties and Uses of Pure Oxide Heavy Refractories. Jour. Am. Ceram. Soc., vol. 32, No. 2, February 1949, pp. 48-53.

Thermal conductivity, high-temperature load-bearing resistance, reheat shrinkage, and porosity were determined on new pure oxide heavy refractories of alumina, magnesia, and stabilized zirconia. Alumina refractories were shown to be capable of lining furnaces for operation to 1,900° C., and magnesia and stabilized zirconia refractories to at least 2,300° C. The thermal conductivity of alumina refractories was found to vary directly with density, and 4 mixtures are described with conductivities ranging from 6 to 18 B.t.u. per hr. per sq. ft. per in. per °F. at 1,800° F. Stabilized zirconia refractories, although having twice the bulk density of fire-clay brick, showed lower thermal conductivity. The uses and limitations of pure oxide heavy refractories are discussed.

944. _____. Properties and Uses of Zirconia Products. Brick and Clay Record, vol. 118, No. 3, March 1951, pp. 58-59.

The important properties of stabilized zirconia that account for its expanding use are: The highest melting point of all commercial refractories that will withstand oxidizing or moderately reducing atmospheres without volatilization; the lowest thermal conductivity of all commercial refractory materials, making it an excellent heat insulator; good thermal shock resistance developed by control of crystal composition; low reactivity, which has resulted to date in uses involving contact at high temperatures with titanates and molten steel and low electrical resistivity at high temperatures, allowing use as an electrical resistor. Its properties make it valuable as a refractory.

See also abs. 569.

945. WICK, E. Comparison of Corrosion Properties of Zirconium, Titanium, Tantalum, Stellite No. 6, and Type 316 Stainless Steel. Materials and Methods, vol. 35, No. 1, January 1952, pp. 115-117.

The corrosion properties of zirconium, titanium, tantalum, Stellite No. 6, and Type 316 stainless steel are given in tables.

946. WIEDLING, T. /Directional Correlation Measurements on Successive Nuclear Gamma Rays in Hf^{177}./ Arkiv Fysik, vol. 6, No. 4, Nov. 14, 1951, pp. 39-48.

Gamma-gamma angular correlation of measurements were performed on hafnium. Descriptive drawings of apparatus and circuits are included. Results are presented in table form and discussed.

WIENER, G. See abs. 854.

WILBER, D. T. See abs. 647.

Generated on 2024-09-20 18:10 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

WILEY, L. A. See abs. 217.

WILHELM, H. A. See abs. 1, 850.

WILKINSON, G. See abs. 317.

947. WILKINSON, R. G. Magnesium and Its Alloys. Metallurgia, vol. 37, No. 218, December 1947, pp. 85-90.

During the year there has been steady progress in the development of new applications for magnesium alloys and the restoration of those that existed before the war. Products incorporating these alloys are contributing to the export drive. The main factor has been the establishment of suitable ingot production and foundry technique for commercial casting alloys to meet the need for increased production of castings at competitive prices. Wrought alloys continue to comprise a minor proportion of the total output, but the development of new high-strength alloys will increase applications involving wrought products. Further notable advances have been made in research and development, particularly in the field of cast and wrought zirconium-containing alloys. This review indicates that the magnesium industry has laid a firm foundation on which to build steadily and progressively.

948. WILKINSON, R. G., AND FOX, F. A. Hot Working of Magnesium and Its Alloys. Jour. Inst. Metals, vol. 76, No. 5, January 1950, pp. 473-500.

Current practice in the rolling, extrusion, and forging of magnesium-base alloys in the United Kingdom is described. Special mention is made of the metallurgical factors that have led to the great advances in quality and economy of production that have taken place over about the last 10 years. The importance of the direct-chill casting process is emphasized; stock is produced in the new zirconium-containing high-strength alloys can be hot worked over a wide temperature range, use of initial temperatures as high as 500°-520° C. permitting heavy reductions to be effected without failure. Short accounts are given of United Kingdom and United States development projects, which have shown that modern magnesium-base alloys can be hot-worked under drastic conditions similar to those applied to mild steel. Comments are made on some possible future lines of development. The compositions and properties of the principal alloys are given, and the effects of varying working conditions are indicated.

WILLARD, H. H. See abs. 298.

949. WILLARD, H. H., AND FREUND, H. Fractional Separation of Hafnium and Zirconium by Means of Triethylphosphate. Ind. Eng. Chem., anal. ed., vol. 18, No. 3, March 1946, pp. 195-197.

This study is an extension of previous work on separations in which the precipitating ion was not added as such, but formed slowly by hydrolysis in solution. The principles set forth in the original work on the slow formation of hydroxyl ion were confirmed. When the solution is homogeneous with respect to the precipitating ions, the precipitation of a normally galatinous product may be improved to yield a dense, granular, easily filterable precipitate and a great improvement in the efficiency of separation of difficulty separable elements can be attained. Hafnium was separated from zirconium by fractional precipitation of the ethylphosphates obtained by hydrolysis of triethylphosphate in a boiling solution of 6N sulfuric acid. Data from this separation were used to develop an optimum fractionation procedure, resulting in efficient separation of hafnium from a mixture containing a relatively low percentage of hafnium.

950. WILLARD, H. H., AND HAHN, R. F. Determination of Zirconium by Precipitation From Homogeneous Solution. Anal. Chem., vol. 21, No. 2, February 1949, pp. 293-295.

Zirconium can be precipitated quantitatively from solutions of 3.6N in

Generated on 2024-09-20 18:08 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

hydrochloric or sulfuric acid by adding 15 to 20 ml. of trimethyl phosphate and heating for 12 to 15 hours. The precipitate obtained is a mixture of zirconyl methyl phosphate, $ZrO\underline{H}(CH_3)(PO_4)\overline{/}_2 \cdot {}^{8}2H\,O$, and zirconyl phosphate, $ZrO(H_2PO_4)_2$. Upon ignition at 900° to 950° C. this precipitate is completely converted to zirconium pyrophosphate, which is weighted. The method can be used to determine zirconium in samples containing from 2 to 60 mg. of zirconium oxide. Antimony, bismuth, cerous, and stannic ions interfere. Large amounts of ferric, titanium, thorium, and uranyl ions give high results. When acid solutions containing zirconyl ions are treated with an excess of metaphorphoric acid, a soluble metaphosphate complex is formed. A precipitate of zirconyl phosphate is slowly deposited at room temperature. The precipitate thus obtained is more dense than the precipitate formed by direct addition of a soluble orthophosphate, although not so dense as that obtained by precipitation with trimethyl phosphate. This precipitate does not decrepitate upon ignition and is completely converted to zirconium pyrophosphate by heating at 900° to 950° C. Metaphosphoric acid can be used to determine zirconium in samples containing from 0.2 to 200 mg. of zirconium oxide. Best results were obtained by adding a large excess of metaphosphoric acid to solutions 3.6N in sulfuric acid. Bismuth, stannic, and perchlorate ions interfered.

951. WILLIANS, A. E. Magnesium-Zirconium Alloys, Development of Alloying and Fluxing Technique. Metal Treatment and Drop Forg., vol. 17, 1950, pp. 73-77.

The effect of zirconium on magnesium alloys, including grain refinement, improved physical and mechanical properties is reviewed in this short survey. Comparative properties of alloys containing no zirconium are given also.

952. WILLIAMS, C. Zirconium - Another Wonder Metal. Monthly Bus. Rev., vol. 35, Jan. 1, 1953, p. 15.

Zirconium is rapidly becoming important in the atomic energy field with untold potential commercial uses existing. One important use is in making corrosion-resistant equipment. Technologists are faced with the development of ways to increase production and decrease the cost.

953. WILLIAMS, J. L., AND WEAVER, B. S. Preparation of Zirconium Tetrafluoride, Progress Report I. Oak Ridge Nat. Lab., Y-12 Area, June 15, 1950, AECD-3329, 9 pp.

Anhydrous zirconium tetrafluoride, free from significant amounts of oxygen and other impurities, has been prepared by hydrofluorination of ignited zirconium oxide followed by sublimation of ZrF_4 away from any unreacted material. The material so produced has been delivered to the Y-12 Materials Laboratory for use in research leading to the preparation of ductile zirconium metal. Limitations of method and suggested future work are discussed.

954. WILLIAMS, J. L. Preparation of Zirconium Tetrafluoride, Progress Report II. Oak Ridge Nat. Lab., Y-12 Area, Feb. 15, 1951, 12 pp. AECD-3335.

Studies on the preparation of zirconium tetrafluoride by hydrofluorination of the oxide, followed by vacuum sublimation, have been considerably extended since publication of report Y-619. Reaction rates have been determined and equipment design has been improved. Some properties of the high-quality product are discussed.

955. WILLIAMS, T. I. Chromatography: Recent Development and Future Possibilities. Anal. Chim. Acta, vol. 2, 1948, pp. 635-648.

This report covers the development of chromatographic analysis and the application of anion exchange equilibria to the separation of the yttrium group of rare earths. Also reviewed are current theories and predictions of industrial application.

Generated on 2024-09-20 18:09 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

956. WILLIAMS, W. L. Corrosion and Mechanical Properties of Titanium and Zirconium at Normal Temperatures. Naval Eng. Exper. Sta., Annapolis, Md., undated, 44 pp.

The data contained herein expand on the work presented previously in Report C-3501-B dated February 9, 1950. The titanium and zirconium materials investigated represent metal consolidated by powder metallurgy and by several melting processes. These in turn reflect impurity levels, especially of the carbon. One titanium alloy was studied with a nominal composition of 2-1/2 percent Cr-1 percent Fe. The chemical compositions and tensile properties are reported. Corrosion tests are included for long exposure periods in a marine atmosphere and in quiet sea water (fouling conditions). Other corrosion tests include those in slowly moving sea water for titanium with and without coupling to various other metals. Data are presented concerning the resistance of titanium to hydraulic cavitation resistance. The very high order of resistance to marine corrosion continues to be particularly attractive. Further fatigue tests are reported on notched and unnotched specimens.

WILSON, A. S. See abs. 753.

WILSON, C. L. See abs. 193.

957. WINDSOR, M. M. Some Double Fluorides of Zirconium. Jour. Am. Chem. Soc., vol. 48, February 1926, pp. 310-312.

Six new double fluorides of zirconium with the organic bases, aniline, brucine, cinchonine, quinine, quinidine, and strychnine, have been prepared, their probable formulas proposed, and some of their properties noted. No definite solubility determinations were made and, therefore, the idea of a new procedure for the separation of zirconium and titanium could not be fully investigated.

WINSLOW, E. H. See abs. 535, 536, 966.

WISH, L. See abs. 889.

WITHROW, J. R. See abs. 723, 724, 725, 726, 727.

WITTENBERG, L. See abs. 523.

958. WOLFRAM, H. G. Effect of Zirconia in Enamels for Sheet Steel. Jour. Am. Ceram. Soc., vol. 7, No. 1, January 1924, pp. 1-13.

This paper deals with the results obtained from a study of the effect of additions of zirconium oxide to enamels for sheet iron and steel. The work includes additions of the zirconia to the raw smelter batch of both the ground and cover enamels, also the substitution of the zirconia for tin oxide in the mill batch. Several tests were used to determine its effect on some of the properties of the enamels, such as resistance to impact, thermal shock, and acid.

WOLLAN, E. O. See abs. 812.

WOOD, J. P. See abs. 102.

WOODCOCK, K. S. See abs. 179.

WOODHEAD, J. L. See abs. 618.

WOODS, H. W. See abs. 606.

WOOTEN, L. A. See abs. 248.

WROUGHTON, D. See abs. 541.

WROUGHTON, D. M. See abs. 539, 542.

WU, C. S. See abs. 362.

YAVORSKY, P. J. See abs. 245, 246.

959. YENSEN, T. D. Preparation of Pure Alloys for Magnetic Purposes. Trans. Electrochem. Soc., vol. 32, 1917, pp. 165-184. Pres. at 32d General Meet. Am. Electrochem. Soc., Pittsburgh, Pa., Oct. 4, 1917.

The reasons are discussed why pure iron and iron-containing elements, which

Generated on 2024-09-20 18:09 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

do not separate its crystals from each other, have great magnetic permeability and low hysteresis losses. The literature of this subject is reviewed. Descriptions are given of an electrolytic plant for producing pure iron and the various commercial forms in which the alloying elements to be used are obtained. Detailed description is given of electrically fusing magnesia and molding and baking crucibles out of the product. Ordinary and vacuum electric furnaces for making the alloys, at temperatures up to 1,800° C. are described; also annealing furnaces for heat treating the alloys produced. An illustration of the magnetic testing laboratory is shown.

YERKES, L. A. See abs. 503, 506, 508.

YNTEMA, L. F. See abs. 901.

YNTEMA, L. F., AND BEKEBREDE, W. R. Less Common Metals. See abs. 900.

YOLLES, S. See abs. 105, 432.

960. YOUNG, R. C. Anhydrous Lower Bromides of Zirconium. Jour. Am. Chem. Soc., vol. 53, 1931, pp. 2148-2153.

Anhydrous zirconium tribromide has been prepared by reducing the tetrabromide with aluminum in an atmosphere of hydrogen in the hot-cold tube. Appropriate apparatus and manipulation are described. The compound is a blue-black powder that dissolves in water with the evolution of hydrogen, producing a yellow to orange colored solution, the color of which quickly disappears. Trivalent zirconium was found capable of bringing about the following reductions: CrO_4 = to Cr^{+++}, Fe^{+++} to Fe^{++}, Bi^{+++} to Bi, Cu^{++} to Cu^{+}, TiO^{++} to Ti^{++}, and $2H^{+}$ to H_2. The dibromide of zirconium is formed by the decomposition of the tribromide at 350°, the tetrabromide being formed at the same time. Zirconium dibromide is a lustrous black powder that catches fire in the air and reacts with water so vigorously as to cause incandescence even in an atmosphere of nitrogen. Hydrogen is evolved and considerable dioxide of zirconium is formed.

961. _____. Reactions of Zirconium Tetrabromide and Thorium Tetrabromide With Potassium and With Potassium Amide in Liquid Ammonia. Jour. Am. Chem. Soc., vol. 57, July 1935, pp. 1195-1196.

Zirconium tetrabromide was found to be soluble in liquid ammonia and was reduced in this solvent by potassium metal to form a black precipitate and red solution. The reduction product reacted further with evolution of hydrogen to form a compound $Zr(NK)_2.NH_3$, which was also formed by the reaction of zirconium bromide with potassium amide in excess. In equivalent proportions, however, the imide, together with a monopotassium derivative, was formed. No reduction of thorium bromide was observed when it was treated with potassium in liquid ammonia. Reaction took place, however, with evolution of hydrogen and a product ThNHNK. NH_3 was isolated. $Th(NK)_2.KNH_2$ was formed by reaction between thorium bromide and excess potassium amide.

962. YOUNG, R. C., AND FLETCHER, H. G. Anhydrous Zirconium Tetrabromide $ZrO_2 + 2C + 2Br_2 - ZrBr_4 + 2CO$; chap. in Inorganic Syntheses. McGraw-Hill Book Co., Inc., Vol. 1, New York, N. Y., 1939, pp. 49-51.

Zirconium tetrabromide has been prepared by passing carbon dioxide or nitrogen saturated with bromine over a mixture of zirconium dioxide and sugar charcoal or by the action of bromine vapor on zirconium metal, on zirconium carbide, or on zirconium nitride.

963. YOUNGMAN, E. P. Zirconium, Part I, General Information. Bureau of Mines Inf. Circ. 6455, 1931, 30 pp.

A general discussion of zirconium, including: Description and properties; history; uses; alloys; zirconium-bearing

Generated on 2024-09-20 18:03 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

minerals; ores; geographic occurrence; mining and concentration; preparation of the oxide and metal; world production; imports; market and prices; lists of importers, producers, dealers and possible buyers; patents recently reported (1929-30).

964. YOUNGMAN, E. P. Zirconium, Part II, Domestic and Foreign Deposits. Bureau of Mines Inf. Circ. 6456, 1931, 63 pp.

A discussion of world-wide deposits of zirconium.

976. ZAPFFE, C. A. Conversion of Certain Refractory Oxides to a Suboxide Form at High Temperatures. Jour. Am. Ceram. Soc., vol. 27, No. 10, 1944, pp. 293-298.

A preliminary survey of the information published in the fields of chemistry and physics on the suboxide forms of SiO, TiO, ZrO, CrO, AlO, BO, VO, and CbO indicates a new field to be explored in determining the role of these suboxides in the service and failure of refractories and in the chemistry of slags. Several phenomena at the present time are little understood, such as devitrification in reducing atmospheres, volatilization of refractory oxides, and certain slag types now classed as anomalous, may find their explanation in the decomposition of the oxides to low oxide forms under the favorable conditions of high temperature and low oxygen pressure that characterize much of their service.

ZAPPA, L. See abs. 828.

ZEMANY, P. D. See abs. 537.

966. ZEMANY, P. D., WINSLOW, E. H., POKLIMITZ, G. S., AND LIEBHAFSKY, H. A. X-ray Absorption Measurements. Anal. Chem., vol. 21, 1949, pp. 493-497.

A comparative method of measuring X-ray absorption has been devised to reduce the errors of the direct method, used for exploratory analytical work previously reported. In the comparative method, there is rapid commutation in the X-ray beam from the unknown to a suitable standard. The method has been applied with satisfactory results to the identification of pure compounds, the determination of tetraethyllead fluid in gasoline, and the determination of sulfur in crude oils. Deviations that can complicate the interpretation of results are discussed, and experimental data on the zirconia-hafnia system are presented to illustrate one such type of deviation.

967. ZIELEN, A. J. Hydrolytic Polymerization of Zirconium. Radiation Lab., University of California, UCRL-2268, July 1953, 83 pp.

The hydrolysis of zirconium (IV) perchlorate was investigated using an organic complexing agent, thenoyltrifluoroacetone, over a range of zirconium concentrations extending from 10^{-5} molar to 0.3 molar and in 1 and 2 molar perchloric acid solutions at 25° C. The monomeric zirconium species at these acidities is shown to be the simple Zr^{+4} ion. The formation of hydrolysis polymers was found to commence at approximately 10^{-4} molar zirconium in one molar acid and at approximately 5×10^{-4} molar zirconium in two molar acid. The hydrolysis polymers studied are identified as a trimer and a tetramer and are assigned the formulas $Zr_3(OH)_4^{+8}$ and $Zr_4(OH)_8^{+8}$. Equilibrium constants for the observed polymer formation are listed. The results of other investigations of zirconium hydrolysis are discussed and compared with the conclusions of this work.

ZINGESER, P. K. See abs. 681.

968. ZINN, W. H. Engineering and Technical Problems. Midwest Eng., vol. 6, No. 3, August 1953, pp. 12-14.

A talk given by Dr. Zinn, Director of Argonne National Laboratory, at the American Power Conference in Chicago on March 25, 1953, on an operating central station nuclear fueled power plant and

Generated on 2024-09-20 18:10 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

important materials needed for such units. Covered in the discussion are the cost of nuclear fuel; regenerative reactors; uranium supply; radiation damage; moderator materials; structural materials; reactor coolants; and the economic feasibility of reactor power.

969. ZIRCONIUM METALS CORPORATION OF AMERICA. (National Lead Co.). Properties and Prices of Zirconium Metal. October 1952, 28 pp.

The primary purpose of this booklet is to familiarize potential users with the properties of this comparatively new metal, now offered for the first time in commercial quantities at a compatible price. As an introduction to this subject, brief expositions are given of the potential ore supply, the method of manufacture, and the uses so far developed.

ZONIS, I. S. See abs. 44.

ZOPATTI, L. P. See abs. 717.

ZUCKER, E. R. See abs. 565.

ZUMBUSCH, M. See abs. 219.

Generated on 2024-09-20 18:03 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

PATENTS

AHLBERG, J. E. See No. 336.

1. AHLBERG, J. E., AND THOMAS, C. L. (Universal Products Oil Co.). Conversion of Hydrocarbon Oils. United States Patent 2,428,257.

2. AITCHISON, R. B. (The Linde Air Products Co.). Flux-Forming Fuel and Method for Thermally Working Minerals Therewith. United States Patent 2,392,353, Jan. 8, 1946.

3. ALEXANDER, P. P. (Metal Hydrides, Inc.). Production of Alkaline Earth Metal Hydrides and Use Thereof in Reducing Refractory Oxides. Canadian Patent 499,719, Feb. 2, 1954.

4. _____. (Metal Hydrides, Inc.). Zirconium Magnetic Alloy. United States Patent 2,184,769, Dec. 26, 1939.

5. _____. Packing of Powdered Metals. United States Patent 2,284,551, May 26, 1942.

6. _____. (Metal Hydrides, Inc.). Production of Zirconium Hydride. United States Patent 2,427,339, Sept. 16, 1947.

7. _____. (Metal Hydrides, Inc.). Production of Zirconium Nitride. Unites States Patent 2,461,019, Feb. 8, 1949.

See also No. 344.

ALLENDORFER, A. See No. 52.

8. ALLIAGES AUTOPROTEGES. Improvements in Aluminum-Magnesium Alloys. British Patent 503,953, Apr. 12, 1939.

9. ANDERSON, R. J. (The Dow Chemical Co.). Production of Anhydrous Zirconium Fluoride. United States Patent 2,639,218, May 19, 1953.

10. ANDERSON, W. T., JR. (Hanovia Chemical & Manufacturing Co.). Electrical Discharge Device. United States Patent 2,477,279, July 26, 1949.

11. ANGERMAN, A. H. (United States of America as represented by the United States Atomic Energy Commission). Method of Dissolving Difficulty Soluble Metal Sulfates. United States Patent 2,514,115, July 4, 1950.

12. ANICETTI, R. J. (Metal Hydrides, Inc.). Pyrophoric Alloys of Lead and Zirconium and Sparking Devices Containing the Same. United States Patent 2,490,570, Dec. 6, 1949.

13. _____. (Metal Hydrides, Inc.). Pyrophoric Alloy of Zirconium, Lead and Titanium, and Sparking Device Containing the Same. United States Patent 2,490,571, Dec. 6, 1949.

14. ARCHIBALD, R. C., AND EGGERTSEN, F. T. (Shell Development Co.). Protection of High Surface Xerogels. United States Patent 2,519,622, Aug. 22, 1950.

Generated on 2024-09-20 18:02 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

15. ARMISTEAD, W. H. (Corning Glass Works). Optical Glass. United States Patent 2,517,459, Aug. 1, 1950.

16. _____. (Corning Glass Works). Ophthalmic Glass. United States Patent 2,523,264, Sept. 26, 1950.

17. ASKENASY, P. (Chemisch Metallurgische Industriegesellschaft Mit Beschrankter Haftung). Method of Producing White Zirconium Oxide Free of Iron. United States Patent 1,158,769, Nov. 2, 1915.

18. AUSTIN, C. R., AND SCHOFIELD, H. Z. (The Ferro Engineering Co.). Method of Making Composite Refractory. United States Patent 2,534,653, Dec. 19, 1950.

19. AUSTIN, L. W., AND RICK, C. A. (Kaiser Aluminum and Chemical Corp.). Preparation of Periclase. United States Patent 2,641,531, June 9, 1953.

20. AXT, M. O. (F. W. Berk & Co., Ltd.). Process for the Treatment of Zircon Sand. British Patent 544,965, May 5, 1942.

21. _____. (F. W. Berk & Co., Ltd.). Improvements in or Relating to the Production of Zirconia. British Patent 550,288, Jan. 1, 1943.

22. AYRES, J. A. (United States of America as represented by the United States Atomic Energy Commission). Zirconium and Hafnium Recovery and Purification Process. United States Patent 2,567,661, Sept. 11, 1951.

BACON, F. E. See Nos. 329, 330.

23. BAIRD, C. (Crobalt, Inc.). Cutting Metal Alloy. United States Patent 2,299,871, Oct. 27, 1942.

24. BAKER, B. P., AND HARKER, D. C. (Westinghouse Electric Corp.). Circuit Interrupter. United States Patent 2,454,121, Nov. 16, 1948.

25. BALDWIN, W. J. (National Lead Co.). Enamel Opacifier and Method of Use. United States Patent 2,537,955, Jan. 16, 1951.

26. _____. (National Lead Co.). Enamel Opacifier and Method of Using. United States Patent 2,537,956, Jan. 16, 1951.

27. BALL, C. J. P., FOX, F. A., EMLEY, E. F., AND JESSUP, A. C. (Magnesium Elektron, Ltd.). Magnesium Base Alloys. Canadian Patent 490,806, Feb. 24, 1953.

28. _____. (Magnesium Elektron, Ltd.). Magnesium Base Alloys. Canadian Patent 490,807, Feb. 24, 1953.

29. BALL, C. J. P., FOX, F. A., JESSUP, A. C., AND EMLEY, E. F. (Magnesium Elektron, Ltd.). Process for Production of Magnesium Base Alloys Containing Zirconium. United States Patent 2,497,529, Feb. 14, 1950.

30. _____. (Magnesium Elektron, Ltd.). Master Alloy for Introducing Zirconium Into Magnesium. United States Patent 2,497,530, Feb. 14, 1950.

31. BALL, C. J. P., JESSUP, A. C., EMLEY, E. F., AND FISHER, P. A. (Magnesium Elektron, Ltd.). Improvements in or Relating to Magnesium Base Alloys. British Patent 652,230, Apr. 18, 1951.

Generated on 2024-09-20 18:05 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

32. BALL, C. J. P., JESSUP, A. C., EMLEY, E. F., AND FISHER, P. A. (Magnesium Elektron, Ltd.). Alloying Composition for Introducing Zirconium Into Magnesium. United States Patent 2,497,531, Feb. 14, 1950.

33. BALL, C. J. P., JESSUP, A. C., EMLEY, E. F., AND WILSON, J. B. (Magnesium Elektron, Ltd.). Magnesium Base Alloys. Canadian Patent 490,808, Feb. 24, 1953.

34. _____. (Magnesium Elektron, Ltd.). Process for Producing Magnesium-Zirconium Alloys. United States Patent 2,452,894, Nov. 2, 1948.

35. BALL, C. J. P., JESSUP, A. C., AND FISHER, P. A. (Magnesium Elektron, Ltd.). Heat Treatment of Magnesium Base Alloys. Canadian Patent 490,811, Feb. 24, 1953.

36. BALLARD, A. H. (Norton Co.). Process of Molding Zirconia. Canadian Patent 493,228, May 26, 1953.

37. _____. (United States of America as represented by the United States Atomic Energy Commission). Process for Molding Refractory Oxides. United States Patent 2,538,959, Jan. 23, 1951.

38. BALLARD, A. H., AND MARSHALL, D. W. (Norton Co.). Stabilized Zirconia and Method for Producing Same. United States Patent 2,535,526, Dec. 26, 1950.

39. _____. (Norton Co.). Zirconia and Method of Quenching Same and Articles Made Therefrom. United States Patent 2,656,278, Oct. 20, 1953.

40. BALTHIS, J. H. (E. I. du Pont de Nemours & Co.). Polymeric Zirconium Compounds and Method of Preparing Same. United States Patent 2,681,922, June 22, 1954.

BARNES, G. H. See No. 170.

41. BARNES, T. D. (Westinghouse Electric & Manufacturing Co.). Electrical Measuring Device. United States Patent 2,315,579, Apr. 6, 1943.

42. BARTON, L. E. (The Titanium Alloy Manufacturing Co.). Composition of Matter and Method for Producing the Same. United States Patent 1,342,084, June 1, 1920.

43. _____. (The Titanium Alloy Manufacturing Co.). Method of Obtaining Zirconium Oxide. United States Patent 1,351,091, Aug. 31, 1920.

44. BARTON, L. E., AND KINZIE, C. J. (The Titanium Alloy Manufacturing Co.). Method of Separating Zircon From Undesired Substances. United States Patent 1,451,004, Apr. 10, 1923.

45. BATES, J. R. (Houdry Process Corp.). Catalysis. United States Patent 2,349,243, May 23, 1944.

46. _____. (Houdry Process Corp.). Catalysis. United States Patent 2,375,756, May 15, 1945.

47. BATTELLE MEMORIAL INSTITUTE. Refining Refractory Metals. British Patent 150,769, Oct. 4, 1949.

BAUMHARDT, L. C. See No. 285.

Generated on 2024-09-20 18:04 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

BEAUFAIT, L. J., JR. See No. 255.

48. BECKET, F. M. (Electro Metallurgical Co.). Zirconium Alloy and Process of Making Same. United States Patent 1,425,572, Aug. 15, 1922.

49. _____. (Electro Metallurgical Co.). Metal-Treating Composition. United States Patent 1,553,020, Sept. 8, 1925.

50. _____. (Electro Metallurgical Co.). Process for Producing Zirconium Alloys. United States Patent 1,996,037, Mar. 26, 1935.

51. BENNETT, J. G., PIRANI, M., AND THRING, M. W. (C. U. R. A. Patents Ltd.). Improved Refractory Material. British Patent 549,142, Nov. 9, 1942.

BENS, F. P. See No. 229.

BENSING, L. P. See No. 102.

52. BERNSTORFF, H., AND ALLENDORFER, A. (Chemical Marketing Co., Inc.). Process for the Production of Metal Alloys. United States Patent 2,291,865, Aug. 4, 1942.

53. BERYLLIUM DEVELOPMENT CORPORATION IN NEW YORK. /Separation of Water-Soluble Double-Fluoride-Forming Metals or Metalloids from Their Compounds, Particularly from Oxide or Silicate Ores Containing Metallic Impurities./ German Patent 603,476, Oct. 3, 1934.

54. BINDER, W. O. (Union Carbide & Carbon Corp.). Cobalt Base Alloys and Cast Articles. United States Patent 2,684,299, July 20, 1954.

55. BJORKSTEDT, W. G. (Doherty Research Co.). Zircon Refractory. United States Patent 1,872,876, Aug. 23, 1932.

BLOOMFIELD, G. See No. 640.

56. BLUE, R. W. (Houdry Process Corp.). Preparation of Silica Zirconia Gel. United States Patent 2,481,493, Sept. 13, 1949.

57. BLUMENFELD, J. Improvements in or Relating to the Production of Oxides of Titanium. British Patent 307,881, June 11, 1930.

58. _____. /Improvements in the Manufacture of Oxides of Zirconium, Titanium and Similar Materials./ French Patent 671,106, Dec. 9, 1929.

See also No. 625.

59. BLUMENTHAL, W. B. (National Lead Co.). Pharmaceutical Composition Containing Hydrous Zirconia. Canadian Patent 503,469, June 1, 1954.

60. _____. (National Lead Co.). Dye Pigment. United States Patent 2,492,959, Jan. 3, 1950.

61. _____. (National Lead Co.). Method for Preparing Ammonium Zirconium Sulfate Salt. United States Patent 2,525,474, Oct. 10, 1950.

Generated on 2024-09-20 18:09 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

Digitized by Google

Original from
THE OHIO STATE UNIVERSITY

62. BLUMENTHAL, W. B. (United States of America as Represented by the United States Atomic Energy Commission). Method of Making Zirconium Tetrachloride. United States Patent 2,626,203, Jan. 20, 1953.

63. _____. (National Lead Co.). Zirconium Pigments. United States Patent 2,626,255, Jan. 20, 1953.

64. _____. (National Lead Co.). Fused Reduced Titania-Zirconia Product and Method. United States Patent 2,653,107, Sept. 22, 1953.

65. BLYTHE, H. J., AND HOCK, A. L. (Magnesium Elektron Ltd.). Production of Potassium Fluozirconates. United States Patent 2,500,792, Mar. 14, 1950.

BOLLER, E. See No. 190.

66. BOND, D. C., AND SAVOY, M. (The Pure Oil Co.). Preparation of Isoparaffins. United States Patent 2,425,416, Aug. 12, 1947.

67. BOND, G. R., JR. (Houdry Process Corp.). Preparation of Zirconia Containing Catalysis. United States Patent 2,444,913, July 13, 1948.

68. BONNET, L. Ceramic Compositions. British Patent 653,980, May 30, 1951.

BORCHERS, W. See No. 538.

69. BOZEL-MALETRA. (Société Industrielle de Produits Chimiques). /Caustic Fusion of Zircon./ French Patent 714,284, Nov. 10, 1931.

70. _____. (Société Industrielle De Produits Chimiques). /Method of Purifying ZrO_2./ French Patent 714,285, Nov. 10, 1931.

71. BRAID, M. Dental Alloy. United States Patent 2,246,288, June 17, 1941.

72. BRITISH NONFERROUS METALS RESEARCH ASSOCIATION. Aluminum βBrasses Containing Titanium and/or Zirconium. British Patent 150,369, May 25, 1950.

73. BRITISH THOMSON-HOUSTON COMPANY, LIMITED. Improvements in and Relating to Tungsten Alloys Particularly for Electric Lamp Filaments. British Patent 162,907, May 12, 1921.

74. _____. Improvements in and Relating to Ceramic Seals. British Patent 636,841, May 10, 1950.

75. BROWN, J. L. Electrolytic Manufacture of Colloids. United States Patent 1,910,212, May 23, 1933.

76. _____. Process Relating to Colloids and Their Characteristics. United States Patent 1,934,294, Nov. 7, 1933.

77. BRUSON, H. A., AND NIEDERHAUSER, W. D. /The Resinous Products and Chemical Company/. Dimeric Octadecadienonitrile. United States Patent 2,435,553, Feb. 3, 1948.

78. BUCKLEY, C. J., AND HAGELSTON, P. J. (Sylvania Electric Products Inc.). Method of Making Lamp Basing Cement. United States Patent 2,508,327, May 16, 1950.

Generated on 2024-09-20 18:01 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

79. BURGESS, L. Process for Production of Zirconium Compounds. United States Patent 1,418,528, June 6, 1922.

80. BURNSIDE, D. G. (Radio Corporation of America). Method of Metallizing Ceramics. United States Patent 2,667,431, Jan. 26, 1954.

81. BUSBY, T. S., MANNERS, M., AND PARTRIDGE, J. H. (The General Electric Co., Ltd.). Refractory Materials. United States Patent 2,675,323, Apr. 13, 1954.

BUTTERBAUGH, D. J. See No. 531.

82. CACHEMAILLE, A. S. Improvements Relating to the Extraction of Metals From Their Compounds. British Patent 238,347, Aug. 20, 1925.

83. _____. Improvements Relating to Extraction of Metals From Their Compounds. British Patent 238,663, Aug. 27, 1925.

84. CAMPBELL, E. D., AND CARNEY, R. J. Recovery of Thorium. United States Patent 1,182,880, May 9, 1916.

85. CANAC, L. H. F., AND SEGOL, E. A. M. A. Alloy. United States Patent 2,288,513, June 30, 1942.

86. _____. (Société "Alliages Autoproteges"). Alloy. United States Patent 2,310,214, Feb. 9, 1943.

CARNEY, R. J. See No. 84.

87. CHAMBERS, F. W. (F. W. Berk & Co., Ltd.). Process for the Removal of the Oxide or Salts of Iron From Zirconium Compounds. British Patent 610,548, Oct. 18, 1948.

88. _____. (F. W. Berk & Co., Ltd.). Process for the Manufacture of Basic Zirconium Sulphate. British Patent 610,549, Oct. 18, 1948.

89. CHANDLER, H. T. (Vanadium Corporation of America). Treatment of Steel or Iron. United States Patent 2,370,289, Feb. 27, 1945.

CHAPPELL, F. L. See No. 623.

90. CLAFLIN, H. C., AND HUBBARD, D. O. (Beryllium Development Corp.). Improvements in or Relating to the Extraction of Metal Values From Ores. British Patent 391,369, Apr. 27, 1933.

91. CLARK, F. L. (Imperial Chemical Industries, Ltd.). Process for the Production of Oxides of Titanium, Thorium or Rare Metals of the Fourth Group. British Patent 339,608, Dec. 8, 1930.

92. _____. (Imperial Chemical Industries, Ltd.). Improvements in or Relating to the Production of Zirconia. British Patent 401,756, Nov. 23, 1933.

93. CLARKE, L. A. (The Texas Co.). Manufacture of Gasoline Hydrocarbons. United States Patent 2,401,859, June 11, 1946.

Generated on 2024-09-20 18:01 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

94. CLAUSSEN, W. F. (The Texas Co.). Manufacture of Gasoline Hydrocarbons. United States Patent 2,400,075, May 14, 1946.

95. COLBERT, W. H., AND WEINRICH, A. R. (Libbey-Owens-Ford Glass Co.). Method of Coating by Evaporating Metals. United States Patent 2,450,856, Oct. 5, 1948.

96. COLES, H. L. (William Sokolec). Aluminum and Chromium and Zirconium Alloy. United States Patent 2,211,764, Aug. 20, 1940.

97. COMSTOCK, G. F. /The Titanium Alloy Manufacturing Co./ Ferro-Aluminum-Zirconium Alloys. United States Patent 2,143,686, Jan. 10, 1939.

See also No. 584.

98. COMSTOCK, G. J., AND WELCH, E. B. (Firth-Sterling Steel Co.). Composition of Matter. United States Patent 1,826,457, Oct. 6, 1931.

99. CONNOLLY, G. C. (Standard Oil Development Co.). Cracking Oils With a Catalyst. United States Patent 2,366,491, Jan. 2, 1945.

100. COOPER, H. S. (The Cooper Co.). Improvements in Alloys. British Patent 113,259, Aug. 14, 1918.

101. _____. (The Cooper Co.). Alloy. Canadian Patent 179,121, Sept. 4, 1917.

102. COOPER, H. S., AND BENSING, L. P. (Kemet Laboratories Co., Inc.) Production of Zirconium Oxide. United States Patent 1,582,126, Apr. 27, 1926.

103. CORBETT, M. A. Improvements in or Relating to the Treatment of Mineral Sand for the Separation of One Constituent Therein From Another. British Patent 406,018, Feb. 12, 1934.

104. _____. Treatment of Mineral Sand for the Separation of One Constituent Therein From Another. United States Patent 2,082,383, June 1, 1937.

105. CORNING GLASS WORKS. Improved Manufacture of Heat Cast Refractories. British Patent 574,652, Jan. 15, 1946.

106. _____. /Transparent Optical Glass and Products Obtained With This Glass. - ZrO_2 One of Several Additions./ French Patent 941,882, Jan. 24, 1949.

107. COSTER, D., AND von HEVESY, G. (N. V. Philips' Gloeilampenfabrieken). Process of Separating Hafnium and Zirconium. British Patent 219,024, July 2, 1925.

108. _____. (N. V. Philips' Gloeilampenfabrieken). Process for Separating Hafnium and Zirconium. British Patent 219,327, Apr. 23, 1925.

109. _____. (N. V. Philips' Gloeilampenfabrieken). Process for Separating Hafnium and Zirconium. British Patent 219,983, Oct. 29, 1925.

110. _____. (N. V. Philips' Gloeilampenfabrieken). Process for Separating Hafnium and Zirconium. British Patent 220,936, July 16, 1925.

111. COSTER, D., AND von HEVESY, G. (N. V. Philips' Gloeilampenfabrieken). Hafnium and Zirconium Separation. Canadian Patent 275,682, Nov. 22, 1927.

Generated on 2024-09-20 18:05 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

Digitized by Google

Original from
THE OHIO STATE UNIVERSITY

112. COSTER, D., AND von HEVESY, G. (N. V. Philips' Gloeilampenfabrieken). Hafnium and Zirconium Separation. Canadian Patent 275,683, Nov. 22, 1927.

113. _____. (N. V. Philips' Gloeilampenfabrieken). Hafnium and Zirconium Separation. Canadian Patent 275,684, Nov. 22, 1927.

114. _____. (N. V. Philips' Gloeilampenfabrieken). Hafnium and Zirconium Separation. Canadian Patent 275,685, Nov. 22, 1927.

115. _____. (N. V. Philips' Gloeilampenfabrieken). Hafnium and Zirconium Separation. Canadian Patent 275,686, Nov. 22, 1927.

116. _____. (N. V. Philips' Gloeilampenfabrieken). Hafnium and Zirconium Separation. Canadian Patent 275,687, Nov. 22, 1927.

117. _____. (N. V. Philips' Gloeilampenfabrieken). Process of Separating Hafnium and Zirconium. United States Patent 1,580,650, Apr. 13, 1926.

118. _____. (N. V. Philips' Gloeilampenfabrieken). Separation of Hafnium and Zirconium. United States Patent 1,586,241, May 25, 1926.

119. _____. (N. V. Philips' Gloeilampenfabrieken). Process of Separating Zirco- and Hafnium. United States Patent 1,618,960, Feb. 22, 1927.

120. _____. (N. V. Philips' Gloeilampenfabrieken). Separation of Hafnium and Zirconium. United States Patent 1,666,440, Apr. 17, 1928.

CRABTREE, J. I. See No. 161.

CRAFTS, W. See No. 287.

CRAIGHEAD, C. M. See No. 281.

121. CROSSLEY, M. L., AND SHAFER, L. M. (Calco Chemical Co., Inc.). Metallized Acid Polyazo Dyes. United States Patent 2,136,650, Nov. 15, 1938.

CULLINAN, J. T. See Nos. 337, 548.

122. D'ADRIAN, A. L. D. (B. F. Drakenfeld & Co., Inc.). Process of Obtaining Chromium, Zirconium, Vanadium, Uranium, Cobalt, Silver, or Nickel. Canadian Patent 229,726, Mar. 20, 1923.

123. _____. (A. L. Duval D'Adrian Chemical Co.). Article of Fused Metallic Oxide and Process of Producing the Same. United States Patent 1,430,724, Oct. 3, 1922.

124. _____. (B. F. Drakenfeld & Co., Inc.). Process of Recovering Metals. United States Patent 1,434,485, Nov. 7, 1922.

125. _____. (B. F. Drakenfeld & Co., Inc.). Process of Recovering Metals. United States Patent 1,434,486, Nov. 7, 1922.

126. DANFORTH, J. D. (Universal Oil Products Co.). Manufacture of Catalysts. United States Patent 2,346,012, Apr. 4, 1944.

Generated on 2024-09-20 18:10 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

127. D'ANS, J. (Deutsche Gasgluhlicht-AuerGesellschaft Mit Beschrankter Haftung). Process for Decomposing Ores of the Rare Earths, of Zirconium and Titanium, in a Cycle by Means of Sulphuric Acid. United States Patent 1,818,770, Aug. 18, 1931.

128. DARLING, S. M. (The Standard Oil Co.). Conversion of Hydrocarbons in the Presence of a Catalyst Comprising Alumina and an Oxyfluoride of Beryllium, Titanium, or Zirconium. United States Patent 2,449,061, Sept. 14, 1948.

129. de BOER, J. H. (N. V. Philips' Gloeilampenfabrieken). Hafnium and Zirconium Salt. Canadian Patent 275,689, Nov. 22, 1927.

130. _____. (N. V. Philips' Gloeilampenfabrieken). Hafnium and Zirconium Separation. Canadian Patent 275,692, Nov. 22, 1927.

131. _____. (N. V. Philips' Gloeilampenfabrieken). Hafnium and Zirconium Separation. Canadian Patent 275,695, Nov. 22, 1927.

132. _____. (N. V. Philips' Gloeilampenfabrieken). Hafnium and Zirconium Separation. Canadian Patent 275,696, Nov. 22, 1927.

133. _____. (N. V. Philips' Gloeilampenfabrieken). Process for Converting Hafnium and Zirconium Phosphates. United States Patent 1,624,162, Apr. 12, 1927.

134. _____. (N. V. Philips' Gloeilampenfabrieken). Separation of Hafnium and Zirconium. United States Patent 1,666,811, Apr. 17, 1928.

135. _____. (N. V. Philips' Gloeilampenfabrieken). Process of Converting Hafnium and Zirconium Salts. United States Patent 1,771,557, July 29, 1930.

See also Nos. 585-594.

136. de GOLYER, A. G. Alloy. United States Patent 2,213,207, Sept. 30, 1940.

137. DENTON, J. J., AND LAWSON, V. A. (American Cyanamid Co.). 3-Amino- 1.2 Diphenyl-Propanol-1. United States Patent 2,515,700, July 18, 1950.

138. de PAOLIS, P. F. (Kodak, Ltd.). Improvements in and Relating to Optical Glass. British Patent 639,335, June 28, 1950.

139. de ROHDEN, C., KASTNER, M., AND PAQUET, M. Process for Preparing Zirconium Compounds. United States Patent 2,564,522, Aug. 14, 1951.

140. DEUTSCHE GASGLUHLIGHT-AUERGESELLSCHAFT MIT BESCHRANKTER HAFTUNG. Process for the Manufacture of Pure Zirconium Compounds. British Patent 222,486, June 18, 1925.

141. _____. Process for the Manufacture of Refractory Substances From High Grade Oxide of Zirconium. British Patent 245,101, Sept. 9, 1926.

142. _____. Process of Decomposing Ores of Zirconium and Other Rare Earth Metals and of Titanium. British Patent 291,004, Feb. 7, 1929.

143. _____. /Method for Preparation of Sinterable Temperature-Resistant Materials./ German Patent 488,356, Dec. 24, 1929.

Generated on 2024-09-20 18:54 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

Digitized by Google

Original from
THE OHIO STATE UNIVERSITY

144. DEUTSCHE GASGLUHLIGHT-AUERGESELLSCHAFT MIT BESCHRANKTER HAFTUNG. /Digestion of Zirconium Ores./ German Patent 522,702, Apr. 13, 1931.

145. _____. /Method for Preparation of Denser and More Stable Objects and Utensils of Zirconium Oxide or Other Refractory Oxides./ German Patent 543,722, Feb. 10, 1932.

146. _____. /Process for Making Objects and Utensils Tight and Resistant of ZrO_2 or Other Heat Resistant Oxides./ French Patent 652,256, Mar. 6, 1929.

147. _____. /Methods for Dissociation of Zirconium Minerals./ French Patent 698,193, Jan. 28, 1931.

148. DEUTSCHE GOLD- UND SILBER-SCHEIDEANSTALT VORMALS ROESSLER IN FRANKFURT a. M. /Process for Conversion of Zirconium Oxide in the Plastic Condition./ German Patent 519,796, Mar. 4, 1931.

149. _____. /Method for Conversion of Zirconium Oxide in the Plastic Condition./ (An Addition to Patent 519,796). German Patent 542,320, Jan. 22, 1932.

150. _____. (Process for Preparation of Anhydrous Metallic Halides. - Be and Cr.) French Patent 817,502, Sept. 4, 1937.

151. DEWEY, B. F. (Lapp Insulator Co., Inc.). Porcelain Insulator Body. United States Patent 2,481,729, Sept. 13, 1949.

152. DILLING, E. D., AND FREDERIC, G. L. (United States of America as represented by the Secretary of the Interior). Process for Removing Scale From Zirconium Metal and Alloys Thereof. United States Patent 2,653,134, Sept. 22, 1953.

153. DIXON, J. K. (American Cyanamid Co.). Catalytic Method of Producing Aromatic Compounds. United States Patent 2,422,164, June 10, 1947.

154. DOMINION TAR AND CHEMICAL COMPANY, LIMITED. Production of Styrenes and Other Aromatic Compounds. British Patent 609,825, Oct. 7, 1948.

155. DONALDSON, K. H. Process of Making Titanium and Other Compounds. United States Patent 2,120,602, June 14, 1938.

156. DORGELO, E. G. (Hartford National Bank & Trust Co.). Getter Structure for Electric Discharge Tubes. United States Patent 2,493,659, Jan. 3, 1950.

157. DRIGGS, F. H. (Westinghouse Lamp Co.). Electrode Material. United States Patent 1,835,026, Dec. 8, 1931.

DUMMETT, W. M. See Nos. 642, 643.

158. DUMMETT, W. M., AND YORK, H. H. Improved Refractory Coating Material. Australian Patent 117,669, Oct. 21, 1943.

DUNN, J. T. See No. 577.

159. EARL, J. A. (The Vitro Manufacturing Co.). Method of Making Ceramic Stains. United States Patent 2,438,335, Mar. 23, 1948.

Generated on 2024-09-20 18:02 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

160. EASTER, G. J. (The Carborundum Co.). Manufacture of Zirconium Compound Refractories. United States Patent 1,816,006, July 28, 1931.

EASTON, R. P. See No. 304.

161. EATON, G. T., AND CRABTREE, J. I. (Kodak, Ltd.). Methods of Hardening Resins, Especially in Photographic Processes. British Patent 559,689, Mar. 1, 1944.

EDWARDS, J. D. See No. 542.

EFIMOFF, V. V. See No. 304.

EGGERTSEN, F. T. See No. 14.

162. ELECTRICAL AND MECHANICAL COMPANY. /Sealing of Ceramics and Its Method of Procedure./ Belgian Patent 482,771, May 28, 1948.

163. ELECTRO METALLURGICAL COMPANY. Process of Preparing Zirconium Alloys Especially Alloys Containing Silicon and Zirconium of Reduced Silicon Content. British Patent 241,844, Oct. 29, 1925.

164. ELEKTROCHEMISCHE FABRIKEN COMPANY, LIMITED. /Method for Preparation of Complex Fluorides./ German Patent 614,784, June 18, 1935.

165. EMLEY, E. F. (Magnesium Elektron, Ltd.) Magnesium Base Alloys. Canadian Patent 490,809, Feb. 24, 1953.

166. _____. (Magnesium Elektron, Ltd.). Process and Composition for Producing Magnesium-Zirconium Alloys. United States Patent 2,452,914, Nov. 2, 1948.

See also Nos. 27-34, 264.

167. EMLEY, E. F., JESSUP, A. C., AND FISHER, P. A. (Magnesium Elektron, Ltd.). Zirconium Carrying Alloy Substance. United States Patent 2,497,537, Feb. 14, 1950.

EMMERT, K. L. See No. 241.

168. EVANS, C. T. (Cyclops Steel Co.). Alloy. United States Patent 1,535,910, Apr. 28, 1925.

169. FAHRENWALD, F. A. Electrical-Resistance Element. United States Patent 1,464,312, Aug. 7, 1923.

170. FAHRENWALD, F. A., PARKINSON, N. F., AND BARNES, G. H. (International Titanium, Ltd.). Process of Electrostatic Separation. United States Patent 2,180,804, Nov. 21, 1939.

171. FARBENINDUSTRIE, A.-G., I. G. Process for the Manufacture of Leather. British Patent 466,135, May 24, 1937.

172. _____. /Process for Producing Zirconium Oxychloride./ French Patent 796,803, Apr. 16, 1936.

Generated on 2024-09-20 18:20 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

173. FARBENINDUSTRIE, A.-G., I. G. /Process for Tanning - Using Soluble Zirconium Salts./ French Patent 798,137, May 9, 1936.

174. _____. /Method for Making Zirconium Metal - Bomb Reduction of $ZrCl_4$ With Mg at 1 mm. Pressure./ French Patent 847,196, Oct. 4, 1939.

175. FEILD, A. L. (The Electro Metallurgical Co. of Canada, Ltd.). Process of Removing Silicon From Zirconium Alloy. Canadian Patent 256,563, Dec. 22, 1925.

176. _____. (Electro Metallurgical Co.). Process of Preparing Silicon-Zirconium Alloys of Reduced Silicon Content. United States Patent 1,544,824, July 7, 1925.

177. _____. (Electro Metallurgical Co.). Alloy and Process of Making the Same. United States Patent 1,684,696, Sept. 18, 1928.

178. _____. (Armco Steel Corp.). Coated Cobalt Alloy Products. United States Patent 2,513,303, July 4, 1950.

179. FIELD, T. E. (Corhart Refractories Co.). Cast Refractory Product. Canadian Patent 417,673, Jan. 11, 1944.

180. _____. (Corhart Refractories Co.). Cast Refractory Products. Canadian Patent 501,260, Apr. 6, 1954.

181. _____. (Corning Glass Works). Improved Manufacture of Refractory Materials. British Patent 544,197, Apr. 1, 1942.

182. _____. (L'Electro Refractaire Anonyme in Paris). /Cast Refractory Products./ German Patent 802,620, Feb. 15, 1951.

183. _____. (Corhart Refractories Co.). Cast Refractory Product. United States Patent 2,271,366, Jan. 27, 1942.

184. _____. (Corhart Refractories Co.). Refractory Casting. United States Patent 2,297,546, Sept. 29, 1942.

See also Nos. 194-204.

185. FIELD, T. E., AND SMYTH, H. T. (Corhart Refractories Co.). Method of Producing Cast Refractory. United States Patent 2,381,945, Aug. 14, 1945.

FISHER, P. A. See Nos. 31, 32, 35, 167, 264.

186. FOLKINS, H. O., AND MILLER, E. (The Pure Oil Co.). Catalysts and Process for the Production of Carbon Disulfide by Reaction of Hydrocarbons and Sulfur Vapor. United States Patent 2,536,680, Jan. 2, 1951.

FOX, F. A. See Nos. 27-30.

FREDERIC, G. L. See No. 152.

187. FREEDMAN, P., AND GREETHAM, E. Method of Extraction of Metals From Their Compounds. United States Patent 1,433,541, Oct. 31, 1922.

Generated on 2024-09-20 18:02 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

Digitized by Google

Original from
THE OHIO STATE UNIVERSITY

188. FREY, F. E. (Phillips Petroleum Co.). Catalytic Reconstruction of Hydrocarbons. United States Patent 2,418,023, Mar. 25, 1947.

189. FREY, W. (Saeurefabrik Schweizerhall). Process for the Production of Purified Anhydrous Zirconium Tetrahalide. United States Patent 2,682,445, June 29, 1954.

190. FREY, W., AND BOLLER, E. (Saeurefabrik Schweizerhall). Method of Purifying Liquid Metal Chlorides. Canadian Patent 496,367, Sept. 22, 1953.

191. FRIED. KRUPP A.-G. Improvements in the Manufacture of Permanent Magnet Alloys. British Patent 524,420, Aug. 6, 1940.

192. _____. /Artificial Replacement Parts for the Interior of the Human or Animal Body, Particularly Dentures, As Well As Needles for Medical, and Particularly Dental Purposes./ German Patent 607,975, Jan. 23, 1935.

193. FULCHER, G. S. (Corning Glass Works). Cast Refractory Product. United States Patent 1,615,751, Jan. 25, 1927.

194. FULCHER, G. S., AND FIELD, T. E. (Corning Glass Works). Cast Refractory. Canadian Patent 406,829, Aug. 18, 1942.

195. _____. (Corhart Refractories Co.). Refractory Zirconia Casting. Canadian Patent 417,670, Jan. 11, 1944.

196. _____. (Corhart Refractories Co.). Refractory Zirconia Casting. Canadian Patent 417,671, Jan. 11, 1944.

197. _____. (Corhart Refractories Co.). Refractory Zirconia Alumina Casting. Canadian Patent 417,672, Jan. 11, 1944.

198. _____. (Corning Glass Works). Improved Manufacture of Refractories for Glass Furnaces. British Patent 542,156, Oct. 29, 1941.

199. _____. (Corning Glass Works). Improved Manufacture of Refractory Articles. British Patent 542,157, Dec. 29, 1941.

200. _____. (Corning Glass Works). Improved Manufacture of Castings High in Zirconia. British Patent 542,426, Jan. 8, 1942.

201. _____. (Corhart Refractories Co.). Refractory Zirconia Casting. United States Patent 2,271,367, Jan. 27, 1942.

202. _____. (Corhart Refractories Co.). Cast Refractory. United States Patent 2,271,368, Jan. 27, 1942.

203. _____. (Corhart Refractories Co.). Refractory Zirconia-Alumina Casting. United States Patent 2,271,369, Jan. 27, 1942.

204. _____. (Corhart Refractories Co.). Refractory Zirconia Casting. United States Patent 2,352,530, June 27, 1944.

GARDNER, A. G. See No. 401.

Generated on 2024-09-20 18:04 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

GARNETT, H. J. See No. 518.

205. GARRISON, A. D. (Texaco Development Corp.). Catalytic Conversion of Hydrocarbons. United States Patent 2,425,463, Aug. 12, 1947.

206. GELARIE, A. J. Zirconium Citrate Hexamethylenetetramine. United States Patent 1,905,848, Apr. 25, 1933.

207. GENERAL ELECTRIC COMPANY, LIMITED. Refractory Materials. Australian Patent 153,374, Mar. 4, 1952.

208. _____. Improvements in or Relating to Electric Lamps. British Patent 312,273, Nov. 28, 1929.

209. GEORGE, H., AND LAMBERT, R. (Societe Anonyme des Manufactures des Glaces and Produits Chimiques de Saint-Gobain, Chauny and Cirey). Process for Recovering Zirconium Oxide. United States Patent 2,076,080, Apr. 6, 1937.

GERALD, C. F. See No. 547.

210. GIDE, R. Treatment of Magnesium and Magnesium Base Alloys to Increase Their Resistance to Corrosion. United States Patent 2,512,493, June 20, 1950.

211. GLAZEBROOK, R. T., ROSENHAIN, W., AND RODD, E. H. (The Imperial Trust for the Encouragement of Scientific and Industrial Research). Manufacture of a New Compound of Zirconium and Its Application in the Production of Pure Zirconia. British Patent 112,973, Jan. 29, 1918.

GOOD, G. M. See No. 352.

212. GORDON, J. Process of Separating and Extracting Zirconium Oxide (Zirconia) From Ores and Minerals. United States Patent 1,340,888, May 25, 1920.

213. GREENSMITH, D. E. B. Refractories. Canadian Patent 497,666, Nov. 10, 1953.

See also No. 506.

GREETHAM, E. See No. 187.

214. GRENAGLE, J. B. Metal Alloy. Canadian Patent 214,118, Nov. 8, 1921.

215. _____. Alloy and Process of Producing the Same. United States Patent 1,248,648, Dec. 4, 1917.

216. _____. (Rare Metals Reduction Co.). Metal Alloy. United States Patent 1,334,089, Mar. 16, 1920.

217. _____. Process of Making an Alloy. United States Patent 1,845,145, Feb. 16, 1932.

218. GRENKO, J. D., AND STRAWN, L. R. (The Texas Co.). Polymerization of Hydrocarbons. United States Patent 2,404,628, July 23, 1946.

GRIEST, E. M. See No. 365.

Generated on 2024-09-20 18:04 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

219. GRIFFITHS, W. T., AND PFEIL, L. B. Improvements in Heat Resistant Alloys. British Patent 459,848, Jan. 11, 1937.

220. GRUNDY, E. K. (Improvement of Molds for Rails or Similar Arrangements.) Belgian Patent 511,648, June 14, 1952.

221. GUERTLER, W. Improvements in or Relating to Gold- and Silver-Zirconium Alloys. British Patent 440,450, Dec. 19, 1935.

222. GUERTLER, W. Improvements in or Relating to Constructional Parts or Articles Manufactured From Copper-Zirconium Alloys. British Patent 440,480, Dec. 19, 1935.

223. _____. (Application of Gold-Zirconium Alloys.) German Patent 643,568, Apr. 12, 1937.

224. _____. (Industrial Applications of Alloys Containing Zirconium.) French Patent 771,176, Oct. 2, 1934.

225. HAENSEL, V., AND IPATIEFF, V. N. (Universal Oil Products Co.). Process for Reducing the Olefin Content of an Olefinic Distillate. United States Patent 2,401,636, June 4, 1946.

HAGELSTON, P. J. See No. 78.

HAKE, D. S. See Nos. 305-311, 619.

226. HALE, G. C., AND HART, D. Fuse Powder Composition. United States Patent 2,461,544, Feb. 15, 1949.

227. HALL, J. H. (Birdsboro Steel Foundry & Machine Co.). Manufacture of Foundry Molds. United States Patent 2,169,384, Aug. 15, 1939.

228. HALL, R. D. (Westinghouse Electric Corp.). Consolidation of Metal Powder. United States Patent 2,675,310, Apr. 13, 1954.

229. HAM, J. L., BENS, F. P., HERZIG, A. J., AND TIMMONS, G. A. (Climax Molybdenum Co.). Molybdenum-Zirconium Alloys. United States Patent 2,678,271, May 11, 1954.

230. HANSEN, J. R. (Crucible Steel Company of America). Permanent Magnets and Alloys Therefor. United States Patent 2,499,861, Mar. 7, 1950.

231. _____. (Crucible Steel Company of America). Permanent Magnets and Alloys Therefor. United States Patent 2,499,862, Mar. 7, 1950.

232. HANSON, A. O. (United States of America as represented by the United States Atomic Energy Commission). Device for Generating Neutrons. United States Patent 2,576,600, Nov. 27, 1951.

HARKER, D. C. See No. 24.

233. HARRINGTON, R. H. (General Electric Co.). Double Aged Copper Base Alloys. United States Patent 2,275,188, Mar. 3, 1942.

HART, D. See No. 226.

Generated on 2024-09-20 18:09 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

234. HARTMANN, M. L. (The Carborundum Co.). Zirconium Carbide. United States Patent 1,576,275, Mar. 9, 1926.

235. HARTOUGH, H. D., AND KOSAK, A. I. (Socony Vacuum Oil Co., Inc.). Acylation of Thiophene. United States Patent 2,458,512, Jan. 11, 1949.

236. HATCH, G. G. (Kennecott Copper Corp.). Method for Recovering Refractory Metals. United States Patent 2,676,882, Apr. 27, 1954.

237. HATHAWAY, A. J., III. (National Lead Co.). Hydration Resistant Calcium Oxide Refractories. United States Patent 2,678,887, May 18, 1954.

238. HAWLEY, H. K. (The Procter & Gamble Co.). Preparation of a Coprecipitated Nickel-Zirconium Catalyst. United States Patent 2,564,331, Aug. 14, 1951.

239. HEANY, J. A. (The Sirian Lamp Co.). Zirconium and Rare Earth Metal Alloy. Canadian Patent 323,320, June 14, 1932.

HELLER, A. See Nos. 444, 445.

240. HELLER, A., AND PIRANI, M. (C. U. R. A. Patents, Ltd.). Improvements in the Manufacture of Refractory Materials. British Patent 607,317, Aug. 30, 1948.

HENRY, D. E. See No. 465.

241. HENSEL, F. R., EMMERT, K. L., AND WIGGS, J. W. (P. R. Mallory and Co., Inc.). Contact. United States Patent 2,195,307, Mar. 26, 1940.

242. HENSEL, F. R., AND LARSEN, E. I. (P. R. Mallory & Co., Inc.). Alloy. United States Patent 2,127,596, Aug. 23, 1938.

243. _____. (P. R. Mallory & Co., Inc.). Copper-Zirconium-Manganese Alloy. United States Patent 2,130,996, Sept. 20, 1938.

244. _____. (P. R. Mallory & Co., Inc.). Copper Alloys. United States Patent 2,137,281, Nov. 22, 1938.

245. _____. (P. R. Mallory & Co., Inc.). Copper Base Alloys. United States Patent 2,161,468, June 6, 1939.

246. HERAEUS-VACUUMSCHMELZE A.-G. /Application of Alloys to Uses Requiring Extremely High Heat Resistance at High Temperatures./ German Patent 735,990, June 3, 1943.

247. HERAEUS-VACUUMSCHMELZE A.-G., AND ROHN, W. /Method of Preparation of the Metals Silicon, Titanium, Zirconium, Hafnium, Thorium, Vanadium, Columbium, Chromium, and Molybdenum./ German Patent 600,369, Sept. 29, 1934.

HERZIG, A. J. See No. 229.

HIGGINS, W. F. See No. 369.

248. HOBBS, M. A. (Aluminum Company of America). Method of Enhancing Physical Properties of Aluminum Base Alloys Containing Zinc and Magnesium. United States Patent 2,506,788, May 9, 1950.

Generated on 2024-09-20 18:05 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

HOCK, A. L. See No. 65.

249. HOLST, G. /Application of Copper Alloys to Electrical Conductors./ German Patent 691,138, May 18, 1940.

250. HOLST, G., AND COSTERHUIS, E. (N. V. Philips' Gloeilampenfabrieken). Electric Discharge Tube. United States Patent 1,70k,849, Feb. 12, 1929.

251. HOMERBERG, V. O. (The Nitromal Corp.). Ferrous Alloy. United States Patent 1,944,178, Jan. 23, 1934.

252. HOPF, P. P., LYNAM, C. G., AND WEIL, H. Improvements in or Relating to Chromatographic Adsorption Processes for the Separation and Purification of Materials. British Patent 585,224, Feb. 3, 1947.

253. HORSFIELD, B. Treatment of Material Particles. United States Patent 2,290,686, July 21, 1942.

HUBBARD, D. O. See No. 90.

254. HUFF, L. C. (Universal Oil Products Co.). Process for the Conversion of Fluid Reactants. United States Patent 2,407,700, Sept. 17, 1946.

255. HUFFMAN, E. H., AND BEAUFAIT, L. J., JR. (United States of America as represented by the United States Atomic Energy Commission). Zirconium and Hafnium Separation Process. United States Patent 2,566,665, Sept. 4, 1951.

256. HUMMITZSCH, W. (Gebr. Bohler & Co., A.-G.). Electrode for Cutting and Welding Under Water. United States Patent 2,552,176, May 8, 1951.

257. HUNTER, R. (Metal-Gas Co., Ltd.). Treatment of Metals. Canadian Patent 493,758, June 16, 1953.

258. HUNYADY, I. Improvements in and Relating to the Treatment of Ores Containing Aluminum and/or Copper. British Patent 456,500, Nov. 10, 1936.

259. HURD, L. C., VANDER WEYDEN, A. J., AND STROUPE, J. D. (Rohm and Haas Co.). Zirconia Opacifiers and Method of Making. United States Patent 2,455,123, Nov. 30, 1948.

260. HUTCHINS, O. (The Carborundum Co.). Treatment of Zirconium Ores. United States Patent 1,427,816, Sept. 5, 1922.

IPATIEFF, V. N. See No. 225.

IRWIN, J. See No. 390.

IVERSON, W. E. See No. 497.

261. JACKSON, D. R. (Carbide & Carbon Chemicals Corp.). Catalyst Revivification. United States Patent 2,439,852, Apr. 20, 1948.

262. JEANPROST, M. C. /Method of Preparing Metal Salts and Alloys - Fluorides./ French Patent 819,874, Oct. 28, 1937.

Generated on 2024-09-20 18:03 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

263. JERNSTEDT, G. W. (Westinghouse Electric Corp.). Cleaning and Activating Compositions and Use Thereof in Producing Protective Phosphate Coatings on Metal Surfaces. United States Patent 2,490,062, Dec. 6, 1949.

JESSUP, A. C. See Nos. 27-35, 167.

264. JESSUP, A. C., EMLEY, E. F., AND FISHER, P. A. (Magnesium Elektron, Ltd.). Magnesium Base Alloys. United States Patent 2,549,955, Apr. 24, 1951.

265. JESSUP, A. C., AND WILSON, J. B. (Magnesium Elektron, Ltd.). Magnesium Base Alloys. Canadian Patent 490,810, Feb. 24, 1953.

266. _____. (Magnesium Elektron, Ltd.). Composition for Introducing Zirconium and Beryllium Solubly Into Magnesium. United States Patent 2,497,551, Feb. 14, 1950.

267. JOHANNSEN, F. (Fried. Krupp Grusonwerk A.-G.). Treatment of Ores and Metallurgical Products. United States Patent 1,618,204, Feb. 22, 1927.

268. JOHNSON, A. F. (Reynolds Metals Co.). Refractory. Canadian Patent 461,648, Dec. 6, 1949.

269. JORDAN, J. F. Production of Pure Dihalides. United States Patent 2,670,270, Feb. 23, 1954.

270. KALI-CHEMI A.-G. Process of Working Up Calcined Zirconium-Lime Products. British Patent 300,271, July 11, 1929.

271. _____. /Digestion of Zirconium Ores./ German Patent 509,514, Oct. 9, 1930.

272. _____. /Process for Treatment of Zircon-Calcium Ignition Products./ German Patent 509,515, Oct. 9, 1930.

273. _____. /Process of Treating Calcined Products With a Base of ZrO_2 and CaO./ French Patent 662,507, Aug. 8, 1929.

274. KALLEN, G. Refractory Mass, Articles and the Like. British Patent 221,852, Sept. 12, 1924.

275. KAMISHIMA, Y. Alloy Containing Zirconium and Tungsten for the Principal Constituent. British Patent 387,699, Feb. 7, 1933.

276. _____. Alloy Containing Zirconium and Tungsten for the Principal Constituents. United States Patent 1,926,775, Sept. 12, 1933.

277. KARL, A. Improvements in and Relating to the Production of Zirconium Oxide. British Patent 314,526, May 29, 1930.

278. _____. /Improvements Pertaining to the Process for Obtaining ZrO_2 From the Minerals of this Metal./ French Patent 677,621, Mar. 12, 1930.

KASTNER, M. See No. 139.

279. KAWECKI, H. C. (Kawecki Chemical Co.). Production of Alkali Metal Fluotitanates and Fluozirconates. United States Patent 2,653,855, Sept. 29, 1953.

Generated on 2024-09-20 18:07 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

Digitized by Google

Original from
THE OHIO STATE UNIVERSITY

280. KEARBY, K. K. (Standard Oil Development Co.). Production of Olefins. United States Patent 2,526,829, Sept. 2, 1947.

281. KELLER, F., AND CRAIGHEAD, C. M. (Aluminum Company of America). Aluminum Alloy. United States Patent 1,911,080, May 23, 1933.

282. KELLY, J. M. (Westinghouse Electric & Manufacturing Co.). Copper Base Alloy. United States Patent 2,169,187, Aug. 8, 1939.

283. KEMPF, L. W. (Aluminum Company of America). Aluminum Silicon Alloy. United States Patent 1,921,195, Aug. 8, 1933.

284. KIERMAN, W. P. (Westinghouse Lamp Co.). Zirconium and Preparation Thereof. United States Patent 1,760,413, May 27, 1930.

285. KING, B. W., JR., AND BAUMHARDT, L. C. (The Harshaw Chemical Co.). Vitreous Enamel Opacification. United States Patent 2,468,711, Apr. 26, 1949.

286. KING, B. W., JR., AND TESAR, A. O. (The Harshaw Chemical Co.). Ceramic Pigment. United States Patent 2,623,833, Dec. 30, 1952.

287. KINZEL, A. B., AND CRAFTS, W. (Union Carbide & Carbon Corp.). Machine Element. United States Patent 2,046,168, June 30, 1936.

288. KINZIE, C. J. (The Titanium Alloy Manufacturing Co.). Improvement in Methods of Obtaining Zirconium Compounds. British Patent 271,873, Sept. 24, 1928.

289. _____. (The Titanium Alloy Manufacturing Co.). Zirconium-Oxide Complex and Method of Producing and Using the Same. United States Patent 1,562,890, Nov. 24, 1925.

290. _____. (The Titanium Alloy Manufacturing Co.). Method of Making Zirconium Compounds. United States Patent 1,609,826, Dec. 7, 1926.

291. _____. (The Titanium Alloy Manufacturing Co.). Zirconium Compound and Method of Making Same. United States Patent 1,618,287, Feb. 22, 1927.

292. _____. (The Titanium Alloy Manufacturing Co.). Zirconium Oxide Silica Composite and Method of Making Same. United States Patent 1,618,288, Feb. 22, 1927.

293. _____. (The Titanium Alloy Manufacturing Co.). Zirconium, Silicon and Alkali Metal Solutions and Method of Making Same. United States Patent 1,916,226, July 4, 1933.

294. _____. (The Titanium Alloy Manufacturing Co.). Alkali-Metal Zirconium Tartrate and Method of Producing Same. United States Patent 2,013,856, Sept. 10, 1935.

295. _____. (The Titanium Alloy Manufacturing Co.). Zirconium Silicon Alkali Metal Composites and Methods of Making Same. United States Patent 2,013,857, Sept. 10, 1935.

296. _____. (The Titanium Alloy Manufacturing Co.). Zirconium, Silicon Alkali Acid Solution and Method for Stabilizing Same. United States Patent 2,017,125, Oct. 15, 1935.

Generated on 2024-09-20 18:10 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

297. KINZIE, C. J. (The Titanium Alloy Manufacturing Co.). Method of Producing Zirconium Silicate. United States Patent 2,036,220, Apr. 7, 1936.

298. _____. (The Titanium Alloy Manufacturing Co.). Coherent Porous Zirconium Silicates. United States Patent 2,101,947, Dec. 14, 1937.

299. _____. (The Titanium Alloy Manufacturing Co.). Double Silicates of Zirconium and Methods of Making Same. United States Patent 2,127,844, Aug. 23, 1938.

300. _____. (The Titanium Alloy Manufacturing Co.). Method of Making Lead Zirconium Silicate. United States Patent 2,215,737, Sept. 24, 1940.

301. _____. (The Titanium Alloy Manufacturing Co.). Double Silicates of Zirconium and Method of Making Same. United States Patent 2,273,871, Feb. 24, 1942.

302. _____. (The Titanium Alloy Manufacturing Co.). Double Silicates of Zirconium and Method of Making Same. United States Patent 2,273,872, Feb. 24, 1942.

303. _____. (The Titanium Alloy Manufacturing Co.). Zirconium Oxide Opacifier and Method of Making Same. United States Patent 2,310,242, Feb. 9, 1943.

See also No. 44.

304. KINZIE, C. J., EASTON, R. P., AND EFIMOFF, V. V. (The Titanium Alloy Manufacturing Co.). Preparation of Zirconium Dioxide. United States Patent 2,270,527, Jan. 20, 1942.

305. KINZIE, C. J., AND HAKE, D. S. (The Titanium Alloy Manufacturing Co.). Zirconium Oxides and Method of Making Same. United States Patent 2,072,889, Mar. 9, 1937.

306. _____. (The Titanium Alloy Manufacturing Co.). Preparation of a Zirconium Oxycarbide and Silicon Carbide. United States Patent 2,110,733, Mar. 8, 1938.

307. _____. (The Titanium Alloy Manufacturing Co.). Zirconium Carboxide and Method of Making Same. United States Patent 2,143,013, Jan. 10, 1939.

308. _____. (The Titanium Alloy Manufacturing Co.). Method of Making Zirconium Oxide. United States Patent 2,168,603, Aug. 8, 1939.

309. _____. (The Titanium Alloy Manufacturing Co.). Zirconium Oxide and Method of Making Same. United States Patent 2,194,426, Mar. 19, 1940.

310. _____. (The Titanium Alloy Manufacturing Co.). Zirconium Oxide and Method of Making Same. United States Patent 2,206,287, July 2, 1940.

311. _____. (The Titanium Alloy Manufacturing Co.). Method of Making Zirconium Nitrate. United States Patent 2,285,443, June 9, 1942.

312. KINZIE, C. J., AND WAINER, E. (The Titanium Alloy Manufacturing Co.). Refractory. Canadian Patent 397,864, July 8, 1941.

313. _____. (The Titanium Alloy Manufacturing Co.). Improvements in Bonded Refractories. British Patent 543,021, Feb. 6, 1942.

Generated on 2024-09-20 18:09 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

314. KINZIE, C. J., AND WAINER, E. (The Titanium Alloy Manufacturing Co.). Refractory and Method of Making Same. United States Patent 2,220,411, Nov. 5, 1940.

315. _____. (The Titanium Alloy Manufacturing Co.). Refractory and Method of Making Same. United States Patent 2,220,412, Nov. 5, 1940.

316. _____. (The Titanium Alloy Manufacturing Co.). Zirconium Salts of Water-Insoluble Fatty Acids and Methods of Making Same. United States Patent 2,221,975, Nov. 19, 1940.

317. _____. (The Titanium Alloy Manufacturing Co.). Refractory. United States Patent 2,277,704, Mar. 31, 1942.

318. _____. (The Titanium Alloy Manufacturing Co.). Refractory Composition and Method of Making the Same. United States Patent 2,277,705, Mar. 31, 1942.

319. _____. (The Titanium Alloy Manufacturing Co.). Porous Refractory. United States Patent 2,341,561, Feb. 15, 1944.

320. KISTLER, S. S. (Norton Co.). High-Temperature Resistor and Method of Operating It. United States Patent 2,679,545, May 25, 1954.

KLEKAMP, L. E., JR. See No. 383.

321. KOERNER, J. Process of Decomposing Zirconium and Similar Ores. United States Patent 1,467,275, Sept. 4, 1923.

KOHL, H. See No. 463.

KOPIN, S. See No. 498.

KOSAK, A. I. See No. 235.

322. KRCHMA, I. J. (E. I. du Pont de Nemours & Co.). Separating Metal Halide Vapors. United States Patent 2,533,021, Dec. 5, 1950.

323. KROGER, F. A., AND OVERBEEK, J. T. G. (General Electric Co.). Titanium Activated Magnesium Orthostannate. United States Patent 2,542,336, Feb. 20, 1951.

324. KROLL, W. J. Improvements in the Production of Anhydrous Zirconium Tetrachloride and in the Production of Zirconium Therefrom. British Patent 628,147, Aug. 23, 1949.

325. _____. Improvements in Processes and Apparatus for the Treatment of Hafnium, Zirconium, Titanium, Thorium, and Their Alloys in the Molten State. British Patent 633,117, Dec. 12, 1949.

326. _____. /Application of Titanium Alloys./ German Patent 718,822, Mar. 24, 1942.

327. _____. Method of Producing Titanium Alloys. United States Patent 2,522,679, Sept. 19, 1950.

Generated on 2024-09-20 18:08 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

328. KROLL, W. J. (United States of America as represented by the Secretary of the Interior). Process for Melting Hafnium, Zirconium, and Titanium Metals. United States Patent 2,548,897, Apr. 17, 1951.

See also No. 495.

329. KROLL, W. J., AND BACON, F. E. (Electro Metallurgical Co.). Process for Producing Zirconium Chloride. United States Patent 2,443,253, June 15, 1948.

330. _____. (Electro Metallurgical Co.). Process for the Separation of Metals. United States Patent 2,452,665, Nov. 2, 1948.

331. KROPF, A. (Iron-Free Molybdenum-Tungsten-Carbon Alloys, Produced by Smelting.) German Patent 564,202, Nov. 17, 1932.

See also No. 534.

332. KROPF, A., AND STAHLWERKE ROCHLING-BUDERUS A.-G. /Carbide Crucibles./ German Patent 622,275, Nov. 23, 1935.

333. KUMINS, C. A. Zirconium Compound and Method of Precipitation. United States Patent 2,630,370, Mar. 3, 1953.

KUNDIGER, D. G. See No. 531.

334. KUNIANSKY, M. Cast-Iron Pipe. United States Patent 2,490,818, Dec. 13, 1949.

LAMBERT, R. See No. 209.

LARSEN, E. I. See Nos. 242-245.

335. LAUGHLIN, C. C. (The Titanium Alloy Manufacturing Co.). Purification of Titanium Carbide and Similar Materials. United States Patent 2,310,964, Feb. 16, 1943.

LAWE, T. See No. 541.

LAWSON, V. A. See No. 137.

LEE, E. C. See No. 548.

336. LEE, E. C., AND AHLBERG, J. E. (Universal Oil Products Co.). Manufacture of Catalysts. United States Patent 2,289,918, July 14, 1942.

337. LEE, E. C., CULLINAN, J. T., AND THOMAS, C. L. (Universal Oil Products Co.). Conversion of Hydrocarbon Oil. United States Patent 2,406,613, Aug. 27, 1946.

338. LEE, H. H. (Phillips Petroleum Co.). Removal of Hydrogen Halide From a Gaseous Effluent of an Isomerization Process. United States Patent 2,428,883, Oct. 14, 1947.

339. L'ÉLECTRO-RÉFRACTAIRE. /Refractory Products Containing ZrO_2./ French Patent 883,990, July 28, 1943.

340. _____. /Refractory Products - Containing ZrO_2./ French Patent 925,339, Sept. 1, 1947.

Generated on 2024-09-20 18:08 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

341. L'ELECTRO-REFRACTAIRE. [Casting Refractories.] French Patent 952,854, Nov. 25, 1949.

342. _____. (Basic Casting Refractory.) French Patent 952,855, Nov. 25, 1949.

LIEBERT, J. B. See No. 533.

343. LILLIENDAHL, W. C., AND RENTSCHLER, H. C. (Westinghouse Electric Corp.). Manufacture of Zirconium. United States Patent 2,537,068, Jan. 9, 1951.

344. LINDSLEY, T., AND ALEXANDER, P. P. (Metal Hydrides, Inc.). Method of Reducing Refractory Oxides. United States Patent 2,545,821, Mar. 20, 1951.

345. LINN, N. F. (Standard Oil Development Co.). Dehydrogenation of Hydrocarbons. United States Patent 2,392,750, Jan. 8, 1946.

346. LOCKHART, M. C., AND MICHEL, G. H. (American Cyanamid Co.). Vitamin B_{12} Purification Using Zirconium Compounds. Canadian Patent 492,776, May 12, 1953.

347. LÖFFLER, J. (Auergesellschaft A.-G. in Berlin). [Method for Preparation of Chemical Blazes Opacified by Zirconium Compounds.] German Patent 695,760, Sept. 2, 1940.

348. _____. (Auergesellschaft A.-G. in Berlin). [Method for Preparation of Sintered Enamels Opacified by Zirconium Compounds.] German Patent 733,822, Apr. 2, 1943.

349. LOEWEN, R. P., AND STARR, J. H. (Monsanto Chemical Co.). Method for the Production of Alloys. United States Patent 2,651,569, Sept. 8, 1953.

350. LOVEMAN, W. R. (National Carbon Co., Inc.). Process of Purifying Zirconium Ores. United States Patent 1,297,371, Mar. 18, 1919.

351. LOWE, W. G. (Eastman Kodak Co.). Gelling of Polyvinyl Alcohol Coatings. United States Patent 2,455,936, Dec. 14, 1948.

LUCAS, E. A. See No. 550.

352. LUTEN, D. B., JR., AND GOOD, G. M. (Shell Development Co.). Dealkylation of Alkylphenols. United States Patent 2,514,960, July 11, 1950.

LYNAM, C. G. See No. 252.

353. MACKSOUD, M. E. Method of Producing Highly Emissive Electrodes. United States Patent 2,525,263, Oct. 10, 1950.

354. MADDEX, P. J. (Battelle Memorial Institute). Production of Refractory Metals. Canadian Patent 490,184, Feb. 3, 1953.

355. _____. (Battelle Memorial Institute). Production of Refractory Metals. Canadian Patent 490,185, Feb. 3, 1953.

356. _____. (Battelle Development Corp.). Production of Refractory Metals. United States Patent 2,556,763, June 12, 1951.

Generated on 2024-09-20 18:04 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

357. MAGNESIUM ELEKTRON, LIMITED. Improvements in or Relating to the Production of Magnesium Alloys. British Patent 652,222, Apr. 18, 1951.

358. _____. Improvements in or Relating to Magnesium Base Alloys. British Patent 652,224, Apr. 18, 1951.

359. _____. Improvements in or Relating to the Production of Magnesium Base Alloys. British Patent 652,226, Apr. 18, 1951.

360. MAIER, C. G. Method for the Alkaline Roasting of an Acidic Oxide Ore. United States Patent 2,501,952, Mar. 28, 1950.

361. MANLY, R. S. (The Procter and Gamble Co. of Canada, Ltd.). Preparations Containing a Fluoride Complex of a Group IV Metal for Use in Contact With the Teeth. Canadian Patent 502,116, May 4, 1954.

MANNERS, M. See No. 81.

362. MARDEN, J. W. (Westinghouse Lamp Co.). Preparation of Rare Metals. United States Patent 1,437,984, Dec. 5, 1922.

363. MARISIC, M. M. (Socony-Vacuum Oil Co., Inc.). Catalytic Conversion of Hydrocarbons. United States Patent 2,400,465, May 14, 1946.

364. _____. (Socony-Vacuum Oil Co., Inc.). Process of Drying Inorganic Oxide Gels. United States Patent 2,528,767, Nov. 7, 1950.

365. MARISIC, M. M., AND GRIEST, E. M. (Socony-Vacuum Oil Co., Inc.). Preparation and Use of Zirconia Gels in the Conversion of Hydrocarbons. United States Patent 2,442,772, June 8, 1948.

MARSHALL, D. W. See Nos. 38, 39.

MARTINI, H. See No. 544.

MARTINSON, M. W. See No. 532.

366. MASCHINENFABRIK BUCKAU R. WOLF A.-G. /Steam Power Plants - So-Called Traction Engine Plants./ German Patent 492,756, Mar. 3, 1930.

367. MATUSZAK, M. P. (Phillips Petroleum Co.). Process for Producing Diolefins. United States Patent 2,394,625, Feb. 12, 1946.

368. MAUTHE, G., AND NOERR, H. (I. G. Farbenindustrie A.-G.). Manufacture of Leather. United States Patent 2,129,854, Sept. 13, 1938.

369. MAYER, S. E., AND HIGGINS, W. F. (Magnesium Elektron, Ltd.). Protection of Magnesium and Magnesium Base Alloys Against Corrosion. United States Patent 2,509,273, May 30, 1950.

370. McELROY, L. A. (The Macolite Co.). Metal Alloy. United States Patent 2,235,232, Mar. 18, 1941.

371. McKEE, R. H. Method or Process for Making Ferrozirconium. United States Patent 1,401,265, Dec. 27, 1921.

Generated on 2024-09-20 18:08 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

372. McKEE, R. H. Process for Alloying Zirconium and Iron. United States Patent 1,401,266, Dec. 27, 1921.

373. _____. Process of Alloying Zirconium and Iron. United States Patent 1,401,267, Dec. 27, 1921.

374. McLACHLAN, D., JR. (Corning Glass Works). Improved Method of Preparing Finely Comminuted Oxides. British Patent 527,855, Oct. 17, 1940.

375. McMULLEN, J. C. (The Carborundum Co.). Refractory Glass Wool. United States Patent 2,557,834, June 19, 1951.

376. MECCO, J. M. (American Cyanamid Co.). Printing Assistants for Vat Colors Comprising Zirconium Salts. United States Patent 2,650,152, Aug. 25, 1953.

377. METAL HYDRIDES, INCORPORATED. Method for Producing Zirconium Hydride. British Patent 624,458, June 9, 1949.

378. METH, M. (Firth Sterling Steel Co.). Method of Making Refractory Articles. United States Patent 1,862,191, June 7, 1932.

MICHEL, G. H. See No. 346.

MILLER, E. See No. 186.

379. MILLER, J. B. (National Lead Co.). Zirconium Oxide Polishing Material. United States Patent 2,624,661, Jan. 6, 1953.

380. _____. (The Titanium Alloy Manufacturing Co.). Method of Preparing Zirconium Oxide. United States Patent 2,392,605, Jan. 8, 1946.

381. _____. (National Lead Co.). Polishing Material. United States Patent 2,489,307, Nov. 29, 1949.

382. MILLIGAN, L. H., AND WHITTEMORE, O. J., JR. (Norton Co.). Refractory Tube. United States Patent 2,640,503, June 2, 1953.

383. MINER, R. S., JR., AND KLEKAMP, L. E., JR. (Tung-Sol Lamp Works, Inc.). Method of Plating Metals With Zirconium. United States Patent 2,510,128, June 6, 1950.

384. MIX AND GENEST. TELEPHON- UND TELEGRAPHEN-WERKE A.-G. /Manual Switches Particularly for Signal Installations./ German Patent 220,301, Mar. 21, 1910.

385. MOCHEL, J. M. (Corning Glass Works). Method of Making Zircon Refractory. United States Patent 2,553,265, May 15, 1951.

386. MOCKRIN, I., AND PAVLISH, A. E. (Holophane Co., Inc.). Zirconia-Containing Silicate Glass. United States Patent 2,566,134, Aug. 28, 1951.

387. MOERS, K. (General Electric Co.). Method of Applying Coatings on Metals. United States Patent 1,987,576, Jan. 8, 1935.

388. MOND NICKEL COMPANY, LIMITED. Improvements in Castings Made of Nickel-Copper Alloys. British Patent 541,324, Nov. 21, 1941.

Generated on 2024-09-20 18:03 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

Digitized by Google

Original from
THE OHIO STATE UNIVERSITY

389. MOND NICKEL COMPANY, LIMITED. /Improvements of Alloys Containing Nickel./ French Patent 729,125, July 19, 1932.

390. MONK, R. H., AND IRWIN, J. Production of Amphoteric Hydrated Oxides of Metals by Hydrolysis. British Patent 329,041, May 15, 1930.

391. MORGAN, J. D. (Power Patents Co.). High Temperature Refractory. Canadian Patent 387,286, Mar. 5, 1940.

392. _____. (Power Patents Co.). Porous Refractory. Canadian Patent 387,287, Mar. 5, 1940.

393. _____. (Power Patents Co.). Heat Insulating Product. Canadian Patent 387,288, Mar. 5, 1940.

394. _____. (Doherty Research Co.). Zirconium Refractories. United States Patent 1,923,003, Aug. 15, 1933.

395. _____. (Power Patents Co.). Zirconia Zircon Silicon Refractory. United States Patent 2,179,982, Nov. 14, 1939.

396. _____. (Power Patents Co.). Refractory and Method of Manufacture. United States Patent 2,220,019, Oct. 29, 1940.

397. _____. (Cities Service Oil Co.). Porous Refractory and Process of Manufacture. United States Patent 2,243,219, May 27, 1941.

398. _____. (Cities Service Oil Co.). Clay Refractory. United States Patent 2,261,400, Nov. 4, 1941.

399. _____. (Cities Service Oil Co.). Refractory Composition. United States Patent 2,272,039, Feb. 3, 1942.

400. MORROGH, H. (The British Cast Iron Research Assoc.). Improvements Relating to the Manufacture of Cast Iron. British Patent 645,862, Nov. 8, 1950.

401. MORROGH, H., AND GARDNER, A. G. (Union Carbide & Carbon Corp.). Manufacture of Iron Castings. United States Patent 2,536,204, Jan. 2, 1951.

402. MOSER, F. H. (The Standard Ultramarine Co.). Process for Producing Metal Phthalocyanines and Their Derivatives. United States Patent 2,469,663, May 10, 1949.

403. NADEAU, G. F., AND STARCK, C. B. (Eastman Kodak Co.). Laminating Process and Products, United States Patent 2,541,478, Feb. 13, 1951.

404. NATIONAL LEAD COMPANY. Improvements Relating to the Production of Color Lakes. British Patent 667,765, Mar. 5, 1952.

405. NEWELL, H. D. (The Babcock & Wilcox Tube Co.). Nickel Steel Alloys. United States Patent 2,532,117, Nov. 28, 1950.

406. NICHOLSON, E. W. S. (Standard Oil Development Co.). Conversion of Hydrocarbon Oils With Finely Divided Catalyst. United States Patent 2,456,306, Dec. 14, 1948.

Generated on 2024-09-20 18:02 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

407. NICHOLSON, K. C. (The Carborundum Co.). Silicon Carbide Refractory. United States Patent 2,626,826, Apr. 28, 1953.

408. _____. (The Carborundum Co.). Refractory Bodies and Compositions and Methods for Making the Same. United States Patent 2,670,301, Feb. 23, 1954.

NIEDERHAUSER, W. D. See No. 77.

NOERR, H. See No. 368.

409. NORDBERG, M. E. (Corning Glass Works). Graded Seal. United States Patent 2,517,019, Aug. 1, 1950.

410. NORRIS, G. L. (Vanadium Corporation of America). Alloys for Addition to Iron and Steel. United States Patent 2,139,515, Dec. 6, 1938.

411. NOTBOHM, C. /Double-Track Installations on Benches and Loading Pockets./ German Patent 327,142, Jan. 21, 1920.

OOSTERHUIS, E. See No. 250.

OVERBEEK, J. T. G. See No. 323.

412. PACZ, A. Method of Producing Alloys. British Patent 160,426, June 19, 1922.

413. _____. Method of Producing High Temperatures and the Use Thereof for Reducing Refractory Oxides. British Patent 160,427, July 18, 1922.

PAQUET, M. See No. 139.

PARIDGE, J. K. See Nos. 638, 639.

PARKINSON, N. F. See No. 170.

PARTRIDGE, J. H. See Nos. 81, 446.

PAVLISH, A. E. See No. 386.

414. PEEL, G. N. (The Thermal Syndicate, Ltd.). Improved Process for the Manufacture of Refractory Articles. British Patent 554, 955, July 27, 1943.

415. PENNSYLVANIA SALT MANUFACTURING COMPANY. Improved Manufacture of Basic Sulphate of Zirconium. British Patent 153,113, Nov. 4, 1920.

416. PETINOT, N. (United States Ferroalloys Corp.). Process for Producing an Alloy of Zirconium and Lead. United States Patent 1,335,982, Apr. 6, 1920.

417. _____. (United States Ferroalloys Corp.). Process for Producing Alloys Containing Zirconium Carbide. United States Patent 1,335,983, Apr. 6, 1920.

418. _____. Process of Making an Alloy of Nickel and Zirconium. United States Patent 1,387,663, Aug. 16, 1921.

419. _____. (United States Ferroalloys Corp.). Alloy of Iron Zirconium and Silicon and Process for the Production Thereof. United States Patent 1,389,695, Sept. 6, 1921.

Generated on 2024-09-20 18:01 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

420. PEYCHES, I. (Societe Anonyme des Manufactures des Glaces et Produits Chimiques de Saint-Gobain, Chauny and Cirey). Electrolytic Method of Protecting the Wall of a Glass Furnace. United States Patent 2,561,818, July 24, 1951.

421. PFEIL, L. B. Improvements in the Alloying of Metals. British Patent 488,322, July 5, 1938.

422. _____. (The Mond Nickel Co., Ltd.). Improvements Relating to Heat-Resisting Alloys Containing Chromium. British Patent 574,088, Dec. 20, 1945.

See also No. 219.

423. PHILIPS', N. V., GLOEILAMPENFABRIEKEN. Improved Manufacture of Highly Refractory Bodies. British Patent 220,301, Nov. 2, 1925.

424. _____. Process of Separating Zirconium and Hafnium. British Patent 220,358, Aug. 11, 1924.

425. _____. Process of Separating Hafnium and Zirconium. British Patent 220,359, Aug. 11, 1924.

426. _____. Process for Separating a Mixture of Zirconium- and Hafnium Halogenides. British Patent 221,802, Dec. 8, 1925.

427. _____. Improved Process of Dissolving a Mixture of Hafnium and Zirconium Phosphates and of Separating Hafnium and Zirconium. British Patent 235,217, Apr. 8, 1926.

428. _____. Improved Process for Converting Hafnium and Zirconium Phosphates Into Other Hafnium and Zirconium Compounds. British Patent 238,543, Mar. 11, 1926.

429. _____. Improved Process of Separating Hafnium and Zirconium. British Patent 258,243, May 5, 1927.

430. _____. Improved Process of Precipitating Hafnium and Zirconium on an Incandescent Body. British Patent 260,062, Oct. 28, 1926.

431. _____. Improved Process of Separating a Mixture of Hafnium and Zirconium. British Patent 266,800, Feb. 28, 1927.

432. _____. Improvements in or Relating to Electric Filaments and Resistances. British Patent 330,280, June 4, 1930.

433. _____. /Deposition of Ductile Hafnium and Zirconium on an Incandescent Body./ German Patent 476,099, May 11, 1929.

434. _____. Improvements in Electrodes and Other Articles Made From Nickel or Nickel Alloy. British Patent 485,220, May 17, 1938.

435. _____. Improvements in or Relating to Wire-Shaped Bodies of High Tensile Strength and Small Specific Resistance. British Patent 508,330, June 29, 1939.

436. _____. /Electronic Tube With Outer Anode and a Zirconium Getter./ Belgian Patent 509,020, July 17, 1953.

Generated on 2024-09-20 18:02 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

437. PHILIPS', N. V., GLOEILAMPENFABRIEKEN. /Cathode and Process for Its Fabrication./ Belgian Patent 510,092, Sept. 20, 1952.

438. _____. /Solder for Difficulty-Fusible Metals./ German Patent 542,465, Mar. 30, 1930.

439. _____. /Method for Preparation of Zirconium./ German Patent 609,501, Feb. 16, 1935.

440. _____. /Process for Depositing Zirconium or Hafnium or the Two on a Core of a Refractory Material - van Arkel Process./ French Patent 749,383, July 22, 1933.

441. _____. /Filament Bodies Having Good Tensile Strength and Low Electrical Resistivity./ French Patent 836,017, Jan. 9, 1939.

442. _____. /Procedure for the Preparation of a Radio-Active Material./ Dutch Patent 60,910, Apr. 15, 1948.

443. PINES, H., AND WACKHER, R. C. (Universal Oil Products Co.). Isomerization of Saturated Hydrocarbons. United States Patent 2,418,724, Apr. 8, 1947.

PIRANI, M. See Nos. 51, 240.

444. PIRANI, M., AND HELLER, A. (C. U. R. A. Patents, Ltd.). Glazing Compositions for Refractory Materials. British Patent 569,282, May 16, 1945.

445. _____. (C. U. R. A. Patents, Ltd.). Improved Refractory Bricks, Blocks or Like Elements. British Patent 581,598, Oct. 17, 1946.

446. PERANI, M., AND PARTRIDGE, J. H. (Canadian General Electric Co., Ltd.). Vitreous Body. Canadian Patent 394,873, Feb. 25, 1941.

447. POLE, G. R. Calcium Oxide-Chromium Oxide-Zirconium Oxide Refractory. United States Patent 2,231,944, Feb. 18, 1941.

448. _____. Calcium Oxide-Zirconium Oxide Refractory. United States Patent 2,231,945, Feb. 18, 1941.

449. POST, C. B., AND SCHOFFSTALL, D. G. (The Carpenter Steel Co.). Hot Workable Alloy. United States Patent 2,553,330, May 15, 1951.

450. PRANDTL, W. /Separation of Hafnium and Zirconium./ German Patent 546,215, Mar. 10, 1932.

451. _____. Process for the Separation of Hafnium and Zirconium. United States Patent 1,976,293, Oct. 9, 1934.

452. PREIS, H. /Preparation and Production of Finely Dispersed Oxides From Those Elements of Group IV Which Are Capable of Forming Volatile Chlorides./ Swiss Patent 221,309, Aug. 17, 1942.

453. PRIOR, H. D. (National Lead Co.). Superopaque Enamel. Canadian Patent 455,366, Mar. 22, 1949.

Generated on 2024-09-20 18:07 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

Digitized by Google

Original from
THE OHIO STATE UNIVERSITY

454. **PROCTER AND GAMBLE COMPANY.** Method for Preparaing Hydrogenation Catalysts. British Patent 639,972, July 12, 1950.

455. **PUGH, E. J.** (Pennsylvania Salt Manufacturing Co.). Process of Making Basic Zirconium Sulfate. United States Patent 1,376,161, Apr. 26, 1921.

456. **PYK, S. C.** Method for the Production of Zirconium Alloys. United States Patent 2,558,627, June 26, 1951.

457. **QUARTZ AND SILICE.** Improvements in Refractory Compositions. British Patent 594,020, Oct. 31, 1937.

458. **RAMAGE, J. H.** (Westinghouse Electric Corp.). Method of Coating Refractory Readily Oxidizable Metals. United States Patent 2,555,372, June 5, 1951.

459. **RAMPINO, L. D.** (Shell Development Co.). Separation of Preferred Fractions From Apparently Homogeneous Gel Particles. United States Patent 2,508,867, May 23, 1950.

460. **RAMSAY, W. S.** (The Stark Brick Co.). Casting of Ceramic Articles. United States Patent 2,521,128, Sept. 5, 1950.

RANDALL, W. F. See No. 518.

461. **REICHMANN, R.** (Siemens and Halske, A.-G., Siemensstadt). Method of Making Bodies Consisting of Metallic Oxides. United States Patent 2,021,520, Nov. 19, 1935.

462. _____. (Siemens and Halske, A.-G., Siemensstadt). Method of Making Shaped Bodies of Nonplastic Metallic Oxides. United States Patent 2,031,129, Feb. 18, 1936.

463. **REICHMANN, R., AND KOHL, H.** (Diemens and Halske, A.-G., Siemensstadt). Method of Molding Nonplastic Metallic Oxides. United States Patent 1,934,091, Nov. 7, 1933.

464. **REID, J. A.** (Phillips Petroleum Co.). Process for the Conversion of Hydrocarbons. United States Patent 2,389,240, Nov. 20, 1945.

RENTSCHLER, H. C. See No. 343.

465. **RENTSCHLER, H. C., AND HENRY, D. E.** (Westinghouse Electric Corp.). Photoelectric Device and the Manufacture Thereof. United States Patent 2,393,264, Jan. 22, 1946.

466. **RHENANIA-KUNHEIM VERIN CHEMISCHER FABRIKEN A.-G.** Process of Dissociating Zirconium Ores. British Patent 287,424, Nov. 22, 1928.

467. **RICH, M. N.** Recovering Zirconium Oxide. United States Patent 1,460,766, July 3, 1923.

468. _____. (Westinghouse Lamp Co.). Method of Separating Zirconium, Titanium, and Hafnium. United States Patent 1,856,264, May 3, 1932.

RICK, C. A. See No. 19.

Generated on 2024-09-20 18:01 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

469. ROBERTS, S. (General Electric Co.). Ceramic Dielectrics and Method of Making. United States Patent 2,541,833, Feb. 13, 1951.

470. ROBINSON, S. P. (Phillips Petroleum Co.). Mullite-Bonded Zircon Pebbles. United States Patent 2,633,623, Apr. 7, 1953.

RODD, E. H. See Nos. 211, 471-473.

ROHN, W. See No. 247.

ROSENHAIN, W. See No. 211.

471. ROSENHAIN, W., AND RODD, E. H. (The Imperial Trust for the Encouragement of Scientific and Industrial Research, Westminister, England). Manufacture of a New Compound of Zirconium and Its Application in the Production of Pure Zirconia. United States Patent 1,307,881, June 24, 1919.

472. _____. (The Imperial Trust for the Encouragement of Scientific and Industrial Research, Westminster, England). Basic Oxychlorid of Zirconium and Process of Making Same. United States Patent 1,307,882, June 24, 1919.

473. _____. (The Imperial Trust for the Encouragement of Scientific and Industrial Research, Westminster, England). Basic Zirconium Sulfate. United States Patent 1,307,883, June 24, 1919.

474. RUFF, O. Process of Producing Zirconium Dioxide. United States Patent 1,454,564, May 8, 1923.

475. _____. Process for Refining Zirconium-Containing Ores and Other Products Containing Dioxide of Zirconium. United States Patent 1,534,687, Apr. 28, 1925.

476. RÜSBERG, F., AND SCHMID, P. (Rhenania-Kunheim Verein Chemischer Fabriken A.-G.). Process for Producing Zirconium Compounds. United States Patent 1,681,195, Aug. 21, 1928.

477. _____. (Kali-Chemie, A.-G.). Recovering Zirconic Oxide. United States Patent 1,732,662, Oct. 22, 1929.

478. RYAN, L. W. (Lindsay Light Co.). Art of Manufacturing Zirconium Compounds. United States Patent 1,530,139, Mar. 17, 1925.

479. RYSCHKEWITSCH, E. (The Roessler and Hasslacher Chemical Co.). Process for the Manufacture of Articles of Zirconium Oxide. United States Patent 1,847,101, Mar. 1, 1932.

480. SAMUEL, R. L. Improvements in or Relating to Metallic Coatings on Iron and and Steel. British Patent 574,737, Jan. 18, 1946.

481. _____. Process for the Diffusion of Metals Into Iron or Steel. British Patent 575,676, Feb. 28, 1946.

482. SARBEY, M. D. (Hartford National Bank & Trust Co.). Flash Lamp. United States Patent 2,272,779, Feb. 10, 1942.

Generated on 2024-09-20 18:06 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

483. SAUERWALD, F. (Magnesium Development Corp.). Heat Treatment of Magnesium Alloys Containing Zirconium. United States Patent 2,212,130, Aug. 20, 1940.

484. _____. (Magnesium Development Corp.). Magnesium-Zirconium Alloy. United States Patent 2,286,311, June 16, 1942.

485. SÄUREFABRIK SCHWEIZERHALL. /Method of Purification of Crude Volatile Metallic Chlorides Resulting From Chlorination of Oxidized Ores./ Swiss Patent 250,071, Aug. 15, 1947.

486. _____. /Method of Decomposing Volatile Metal Chlorides./ Swiss Patent 262,553, July 15, 1949.

487. _____. /Method of Decomposing Volatile Metal Chlorides./ Swiss Patent 265,192, Nov. 30, 1949.

488. _____. Process for the Production of Metal Oxides. British Patent 641,801, Aug. 23, 1950.

489. _____. Improvements in or Relating to Production of Oxides of Silicon, Titanium, or Zirconium. British Patent 655,647, July 25, 1951.

SAVOY, M. See No. 66.

490. SCHAFER, C. J. Alloy. United States Patent 2,187,630, Jan. 16, 1940.

491. _____. Tool Alloy. United States Patent 2,301,082, Nov. 3, 1942.

492. _____. Tool Alloys. United States Patent 2,307,960, Jan. 12, 1943.

493. _____. Tool Alloy. United States Patent 2,339,357, Jan. 18, 1944.

494. _____. High Tensile Strength, Noncorrosive Alloy. United States Patent 2,360,797, Oct. 17, 1944.

495. SCHLECHTEN, A. W., KROLL, W. J., AND YERKES, L. A. (United States of America as represented by the Secretary of the Interior). Apparatus for Refining Metals. United States Patent 2,482,127, Sept. 20, 1949.

496. SCHLEICHER, H. M. (Scovill Manufacturing Co.). Form for Slip-Casting Ceramics and Method of Making the Same. United States Patent 2,303,303, Nov. 24, 1942.

497. SCHLEICHER, H. M., AND IVERSON, W. E. (Scovill Manufacturing Co. and United States Metal Refining Co.). Refractory and Method of Producing the Same. United States Patent 2,325,553, July 27, 1943.

498. SCHLEICHER, H. M., AND KOPIN, S. (Scovill Manufacturing Co. and United States Metal Refining Co.). Method of Making Zircon Refractories. United States Patent 2,303,304, Nov. 24, 1942.

499. SCHMID, P. /Preparation of Meta Zirconic Acid./ German Patent 509,151, Oct. 4, 1930.

See also Nos. 476, 477.

Generated on 2024-09-20 18:02 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

Digitized by Google

Original from
THE OHIO STATE UNIVERSITY

SCHOFFSTALL, D. G. See No. 449.

SCHOFIELD, H. Z. See No. 18.

500. SCHORNSTEIN, W. O. H. Improvements in and Relating to the Production of Zirconium and Titanium Oxides. British Patent 541,343, Nov. 24, 1941.

501. SCHULTZE, W. A. (Phillips Petroleum Co.). Process for Producing Mercaptans From Olefins and Hydrogen Sulfide. United States Patent 2,426,646, Sept. 2, 1947.

502. SCHWEITZER, C. E. (E. I. du Pont de Nemours & Co.). Preparation of Nitrogen Compounds. United States Patent 2,413,469, Dec. 31, 1946.

503. SEABRIGHT, C. A. (The Harshaw Chemical Co.). Ceramic Pigments. United States Patent 2,441,447, May 11, 1948.

SEGOL, E. A. M. A. See Nos. 85, 86.

504. SERI-HOLDING SOCIETE. Alloys of Beryllium. Australian Patent 107,549, June 8, 1939.

SHAFER, L. M. See No. 121.

505. SHAPLEIGH, J. H. (Hercules Powder Co.). Improvements in or Relating to Process for the Decomposition of Hydrocarbons. British Patent 640,368, July 19, 1950.

506. SHAW, C., SMITH, W. E., AND GREENSMITH, D. E. B. Improvements in or Relating to Refractories. British Patent 621,737, Apr. 19, 1949.

507. SHOELD, M. (The Davison Chemical Corp.). Treatment of Hydrogels. United States Patent 2,430,145, Nov. 4, 1947.

508. SICARD, H. C. (United States Ferroalloys Corp.). Alloy of Iron, Zirconium, and Titanium and Process for the Production Thereof. United States Patent 1,335,991, Apr. 6, 1920.

509. _____. Process for the Production of Low-Carbon Ferrozirconium. United States Patent 1,374,037, Apr. 5, 1921.

510. _____. Process for Producing Zirconium Steel. United States Patent 1,374,038, Apr. 5, 1921.

511. SIEMENS AND HALSKE A.-G. Process for the Production of Sintered Bodies From Metallic Oxides. British Patent 410,988, May 31, 1934.

512. _____. /Method of Making Articles of Porous Objects From Metallic Oxides - Aluminum, Beryllium, Chromium, Manganese, Zirconium, Magnesium, Hafnium./ French Patent 757,864, Jan. 5, 1934.

513. SINGH, M. (Greysham & Co.). Improvements in or Relating to the Manufacture of Cast Irons. Indian Patent 40,209, Dec. 23, 1948.

Generated on 2024-09-20 18:52 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

514. SMITH, H. J. (National Lead Co.). Production of Zirconium Iodide. United States Patent 2,680,670, June 8, 1954.

515. SMITH, J. K. (The Beryllium Corp.). Beryllium-Aluminum Alloy. United States Patent 1,941,230, Dec. 26, 1933.

516. SMITH, J. O., JR. (Tide Water Associated Oil Co.). Catalytic Dehydrogenation of Hydrocarbons. United States Patent 2,424,636, July 29, 1947.

517. SMITH, R. K. (Corning Glass Works). Zircon Refractory and Method of Making It. United States Patent 2,338,209, Jan. 4, 1944.

SMITH, W. E. See No. 506.

518. SMITH, W. S., GARNETT, H. J., AND RANDALL, W. F. Improvements in Magnetic Alloys. British Patent 371,969, May 5, 1932.

SMYTH, H. T. See No. 185.

519. SOCIÉTÉ ANONYME DES MANUFACTURES DES GLACES ET PRODUITS CHIMIQUES DE SAINT-GOBAIN, CHAUNY AND CIREY. /Method for Preparation of Refractory Products./ German Patent 733,879, Apr. 5, 1943.

520. _____. /Process for Separating ZrO_2 From Zircon./ French Patent 762,066, Mar. 20, 1935.

521. SOCIÉTÉ D'ETUDE DES AGGLOMERES. Process for the Commercial Production of Pure Oxide of Zirconium. British Patent 223,572, June 11, 1925.

522. _____. Improvements Relating to Refractory Products and Their Manufacture. British Patent 223,573, Apr. 9, 1925.

523. SOCIÉTÉ DE PRODUITS CHIMIQUES DES TERRES RARES. Improved Method for Obtaining Industrially Pure Double Sodium Zirconium Sulphates. British Patent 606,681, Aug. 18, 1948.

524. _____. Process for Preparing Zirconium Compounds. British Patent 627,493, Aug. 10, 1949.

525. _____. /Enamel for Opaque Ceramics Utilizing ZrO_2 and Method of Preparation./ French Patent 865,757, June 3, 1941.

526. SOCIÉTÉ FRANCAISE RADIOELECTRIQUE. /Improvements in the Process for the Realization and Production of Deposits by Electrophoresis - Zirconium Filaments./ French Patent 938,907, Oct. 28, 1948.

527. SOCIÉTÉ GENERALE DU MAGNESIUM. /Magnesium Alloys - 0.05 to 2 Percent Zirconium and Other Additions./ French Patent 845,843, Sept. 4, 1939.

528. SOCIÉTÉ MINIERE ET INDUSTRIELLE FRANCO-BRESILIENNE. /New Process for Testing Zircon to Obtain ZrO_2./ French Patent 650,937, Feb. 12, 1929.

529. SOMERVILLE, I. C. (Rohm and Haas Co., Inc.). Method of Mineral Tanning. United States Patent 1,940,610, Dec. 19, 1933.

Generated on 2024-09-20 18:06 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

530. SOUTHERN, R. L. (Allegheny Ludlum Steel Corp.). Crucible Interchanging Mechanism for Arc Melting Furnaces. United States Patent 2,651,668, Sept. 8, 1953.

531. SPENCE, L. U., BUTTERBAUGH, D. J., AND KUNDIGER, D. G. (Rohm and Haas Co.). Silica-Zirconia Catalysts and Method of Preparation. United States Patent 2,436,125, Feb. 17, 1948.

532. SPENCE, N. S., AND MARTINSON, M. W. (Dominion Magnesium Ltd.). Production of Magnesium Base Alloys. Canadian Patent 489,403, Jan. 6, 1953.

533. SPENCER CHAPMAN AND MESSEL, LIMITED, AND LIEBERT, J. B. Improvements in and Relating to the Manufacture and Manipulation of Colloidal or Semi-Colloidal Substances, Precipitates or Sediments and the Separation and Recovery of the Liquid or Solid Components. British Patent 249,647, Apr. 1, 1926.

STAHLWERKE RÖCHLING-BUDERUS A.-G. See No. 332.

534. STAHLWERKE RÖCHLING BUDERUS A.-G., AND KROFP, A. /Preparation of Temperature-Resistant Electrical Resistance Tubes, Crucibles and Furnace Lining Material./ German Patent 469,433, Nov. 29, 1928.

535. STANDARD OIL DEVELOPMENT COMPANY. Improvements in or Relating to the Catalytic Treatment of Hydrocarbons. British Patent 585,571, Feb. 12, 1947.

536. _____. Improvements in or Relating to the Catalytic Dehydrogenation of Hydrocarbons. British Patent 587,151, Apr. 6, 1947.

STARCK, C. B. See No. 403.

STARR, J. H. See No. 349.

STEVENS, S. See No. 623.

537. STIMSON, R. W. Improvements Relating to the Manufacture of Alloys. British Patent 247,876, Feb. 25, 1926.

538. STIMSON, R. W., AND BORCHERS, W. Improvements Relating to the Manufacture of Alloys. British Patent 247,634, Feb. 25, 1926.

STRAWN, L. R. See No. 218.

539. STREET, K., JR. (United States of America as represented by the United States Atomic Energy Commission). Zirconium-Hafnium Separation Process. United States Patent 2,546,953, Mar. 27, 1951.

STRINGER, W. E. See No. 622.

STROUPE, J. D. See No. 259.

540. STUDDERS, R. J. (General Electric Co.). Sintered Anisotropic Alnico Magnet. United States Patent 2,546,047, Mar. 20, 1951.

541. STURROCK, M. G., AND LAWE, T. (Dominion Tar and Chemical Co., Ltd.). Production of Aromatic Compounds. United States Patent 2,422,318, June 17, 1947.

Generated on 2024-09-20 18:03 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

542. TAYLOR, C. S., AND EDWARDS, J. D. Aluminum Alloy. United States Patent 1,830,142, Nov. 3, 1931.

543. TEASEL, C. C. (National Foundry Sand Co.). Refractory Material and Method of Making. United States Patent 2,567,088, Sept. 4, 1951.

TEICHMANN, L. See Nos. 603-605.

544. TEICHMANN, L., AND MARTINI, H. (I. G. Farbenindustrie, A.-G.). Process for Decomposing Zirconium Ore. United States Patent 2,204,454, June 11, 1940.

545. TERWILLIGER, C. O. (Ward Leonard Electric Co.). Process of Extracting Zirconia From Ores. United States Patent 1,796,170, Mar. 10, 1931.

TESAR, A. O. See No. 286.

546. THIESS, L. E. (General Electric Co.). Ceramic Sealing Compositions. United States Patent 2,511,679, June 13, 1950.

THOMAS, C. L. See Nos. 1, 337.

547. THOMAS, C. L., AND GERALD, C. F. (Universal Oil Products Co.). Hydrocarbon Conversion Catalyst. United States Patent 2,441,214, May 11, 1948.

548. THOMAS, C. L., LEE, E. C., AND CULLINAN, J. T. (Universal Oil Products Co.). Preparation of a Silica-Alumina-Zirconia Catalyst. United States Patent 2,439,994, Apr. 20, 1948.

THRING, M. W. See No. 51.

THURMER, G. See No. 596.

549. TIEDE, R. L., AND TOOLEY, F. V. (Owens-Corning Fiberglas Corp.). Composition of Glass, Especially for Fibers. United States Patent 2,640,784, June 2, 1953.

TIMMONS, G. A. See No. 229.

550. TISDALE, N. F., AND LUCAS, E. A. (Molybdenum Corporation of America). Production of a Ferrous Composition and Article Therefor. United States Patent 2,509,281, May 30, 1950.

551. TITANIUM ALLOY MANUFACTURING COMPANY. Improved Method of Purifying Zircon. British Patent 450,053, July 9, 1936.

552. _____. /Method for Recovery of Zirconium Salts From Siliceous Zirconium Ores./ German Patent 524,986, May 18, 1931.

553. _____. Zircon Refractories and Methods of Making Same. British Patent 528,845, Nov. 8, 1940.

554. _____. Improvements in and Relating to Insulating Refractories and Methods of Making Same. British Patent 533,910, Feb. 24, 1941.

555. _____. Improvements in Zirconium Oxides and Methods of Making Same. British Patent 535,011, Mar. 26, 1941.

Generated on 2024-09-20 18:10 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

556. TITANIUM ALLOY MANUFACTURING COMPANY. Improvements in and Relating to Refractories and Refractory Moulds for Casting Metallic Articles. British Patent 536,857, May 29, 1941.

557. _____. Refractories and Methods of Making the Same. British Patent 544,628, April 21, 1942.

558. _____. Improvements Relating to Zircon Refractories and Refractory Compositions and Methods of Making the Same. British Patent 545,239, May 15, 1942.

559. _____. Refractory Composition and Method of Making the Same. British Patent 546,387, July 10, 1942.

560. _____. Production of Organo Metallic Compounds. British Patent 547,148, Aug. 17, 1942.

561. _____. Improvements Relating to the Production of Zirconium Nitrate. British Patent 555,988, Sept. 15, 1943.

562. _____. Improvements Relating to the Purification of Crude Zirconium Compounds of Ores. British Patent 559,117, Feb. 4, 1944.

563. _____. Improvements Relating to the Purification of Crude Zirconium Compounds of Ores. British Patent 559,118, Feb. 4, 1944.

564. _____. Improvements Relating to the Preparation of Zirconium Oxide. British Patent 562,620, July 10, 1944.

565. _____. Improvements Relating to the Treatment of Zirconium Oxide. British Patent 564,060, Sept. 12, 1944.

566. _____. Improvements in Methods of Purifying Refractory Carbon-Containing Compounds of Titanium and Zirconium. British Patent 564,603, Oct. 5, 1944.

567. _____. Improvements Relating to the Preparation of Compounds of Titanium and Zirconium. British Patent 569,054, May 2, 1945.

568. _____. Improvements Relating to Refractory Compositions. British Patent 569,078, May 3, 1945.

569. _____. Improvements Relating to Zirconium Oxide Refractories and Methods of Making the Same. British Patent 578,409, June 27, 1946.

570. _____. Improvements Relating to Refractory Articles and Compositions, and Methods of Making the Same. British Patent 584,626, Jan. 20, 1947.

571. _____. Improvements Relating to Compositions for Forming Refractory Structures. British Patent 584,799, Jan. 23, 1947.

572. _____. Improvements Relating to Methods of Preparing Zirconium Oxide. British Patent 601,876, May 13, 1948.

573. _____. Process for the Production of Zirconium and Hafnium Compounds. British Patent 624,120, May 27, 1949.

Generated on 2024-09-20 18:09 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

574. TITANIUM ALLOY MANUFACTURING COMPANY. Vitreous Enamels and Compositions for Use in the Preparation of the Same. British Patent 633,178, Dec. 12, 1949.

575. _____. /Method of Obtaining Zirconium Compounds./ French Patent 635,088, Mar. 7, 1928.

576. _____. /Refractory Compositions - ZrO_2./ French Patent 941,123, Jan. 3, 1949.

TOOLEY, F. V. See No. 549.

577. TOUSSAINT, W. J., AND DUNN, J. T. (Carbide & Carbon Chemicals Corp.). Process for Making Diolefins. United States Patent 2,421,361, May 27, 1947.

578. TRAPP, H. Process for the Manufacture of Pure Zirconium Sulphate. United States Patent 1,648,569, Nov. 8, 1927.

TREBLER, H. A. See No. 623.

579. TYRER, D. Manufacture of Zirconium Compounds. United States Patent 2,201,508, May 21, 1940.

580. UDY, M. J. Improvements in Processes and Compositions for the Production of Alloy Irons and Steels. British Patent 576,133, Mar. 20, 1946.

581. UNIVERSAL OIL PRODUCTS COMPANY. Process for the Conversion of Hydrocarbons. British Patent 559,989, Mar. 15, 1944.

582. _____. Catalyst and Process for Synthesizing Organic Compounds. British Patent 626,071, July 8, 1949.

583. URBAN, S. F. (National Lead Co.). Process for Melting Highly Reactive Metals. United States Patent 2,684,297, July 20, 1954.

584. URBAN, S. F., AND COMSTOCK, G. F. (National Lead Co.). Ferritic Alloy. United States Patent 2,542,220, Feb. 20, 1951.

585. VANADIUM CORPORATION OF AMERICA. Improvements in or Relating to Alloys Particularly for the Production of Alloy Steels. British Patent 561,592, May 25, 1944.

586. van ARKEL, A. E., AND de BOER, J. H. (N. V. Philips' Gloeilampenfabrieken). Hafnium and Zirconium Separation. Canadian Patent 275,688, Nov. 22, 1927.

587. _____. (N. V. Philip's Gloeilampenfabrieken). Hafnium and Zirconium Separation. Canadian Patent 275,690, Nov. 22, 1927.

588. _____. (N. V. Philips' Gloeilampenfabrieken). Hafnium and Zirconium Separation. Canadian Patent 275,691, Nov. 22, 1927.

589. _____. (N. V. Philips' Gloeilampenfabrieken). Hafnium and Zirconium Separation. Canadian Patent 275,693, Nov. 22, 1927.

590. _____. (N. V. Philips' Gloeilampenfabrieken). Hafnium and Zirconium Separation. Canadian Patent 275,694, Nov. 22, 1927.

Generated on 2024-09-20 18:08 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

Digitized by Google

Original from
THE OHIO STATE UNIVERSITY

591. van ARKEL, A. E., AND de BOER, J. H. (N. V. Philips' Gloeilampenfabrieken). Process of Separating Hafnium and Zirconium. United States Patent 1,582,860, Apr. 27, 1926.

592. _____. (N. V. Philips' Gloeilampenfabrieken). Process for Dissolving a Mixture of Hafnium and Zirconium Phosphates and for Separating Hafnium and Zirconium. United States Patent 1,636,493, July 19, 1927.

593. _____. (N. V. Philips' Gloeilampenfabrieken). Process of Separating Hafnium and Zirconium. United States Patent 1,666,800, Apr. 17, 1928.

594. _____. (N. V. Philips' Gloeilampenfabrieken). Process for Dissolving a Mixture of Hafnium and Zirconium Salts and for Separating Hafnium and Zirconium. United States Patent 1,718,616, June 25, 1929.

VANDER WEYDEN, A. J. See No. 259.

595. van GESSEL, K. M., AND van WIJK, W. D. (Radio Corporation of America). Method of Making Metal Bodies Consisting of a Core and a Shell. United States Patent 2,050,820, Aug. 11, 1936.

596. van HOORN, A. J., AND THURMER, G. (The Hartford National Bank and Trust Co.). Vaporization of Metals. United States Patent 2,336,138, Dec. 7, 1943.

597. van MATER, H. L. (National Lead Co.). Treatment of Textiles and Composition Therefor. United States Patent 2,457,853, Jan. 4, 1949.

598. _____. (National Lead Co.). Method of Waterproofing Textiles With Zirconyl Compounds. United States Patent 2,482,816, Sept. 27, 1949.

599. _____. (National Lead Co.). Zirconium Compound Deodorant and Antiperspirant. United States Patent 2,498,514, Feb. 21, 1950.

See also No. 619.

600. van TUYL, J. E. Gaseous Fuel Burner and Flame Spreader. United States Patent 2,549,347, Apr. 17, 1951.

van WIJK, W. D. See No. 595.

von HEVESY, G. See Nos. 107-120.

601. von KANTZOW, H. Improved Electric Heating Resistance. British Patent 434,849, Sept. 10, 1935.

602. von ZEPPELIN, H. Manufacture of Alloys. United States Patent 2,250,687, July 29, 1941.

603. von ZEPPELIN, H., AND TEICHMANN, L. (I. G. Farbenindustrie, A.-G.) /Method for Recovery of Zirconium Metal by Thermal Reduction of Zirconium Chloride./ German Patent 704,933, Apr. 10, 1941.

604. _____. Process for Producing Zirconium Metal. United States Patent 2,214,211, Sept. 10, 1940.

Generated on 2024-09-20 18:10 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

605. von ZEPPELIN, H., AND TEICHMANN, L. Process for Producing Alloys Containing Zirconium. United States Patent 2,235,508, Mar. 18, 1941.

606. VOS, C. Alloy. United States Patent 1,382,146, June 21, 1921.

607. "VULKAN" MASCHINEFABRIKS A.-G. /Arrangement for Centering and Holding Heavy Pieces of Work, Particularly Ingots, While Machining the Convex Surface on Turnings - Recovery Machine Tools./ German Patent 542,852, Jan. 29, 1932.

WACKHER, R. C. See No. 443.

608. WAINER, E. (The Titanium Alloy Manufacturing Co.). Zirconium Oxide Refractory. Canadian Patent 426,574, Apr. 3, 1945.

609. _____. (National Lead Co.). Ceramic Compositions for Aircraft Spark Plugs. Canadian Patent 468,365, Sept. 26, 1950.

610. _____. (The Titanium Alloy Manufacturing Co.). Purification of Zirconium Compounds. United States Patent 2,294,431, Sept. 1, 1942.

611. _____. (The Titanium Alloy Manufacturing Co.). Preparation of Compounds of Zirconium, Titanium and Hafnium. United States Patent 2,316,141, Apr. 6, 1943.

612. _____. (The Titanium Alloy Manufacturing Co.). Refractory Composition. United States Patent 2,323,951, July 13, 1943.

613. _____. (The Titanium Alloy Manufacturing Co.). Method of Making Zirconium Oxide Refractories. United States Patent 2,335,325, Nov. 30, 1943.

614. _____. (The Titanium Alloy Manufacturing Co.). Zirconium Oxide Refractory and Method of Making the Same. United States Patent 2,347,225, Apr. 25, 1944.

615. _____. (The Titanium Alloy Manufacturing Co.). Refractory Composition and Method of Making the Same. United States Patent 2,373,864, Apr. 17, 1945.

616. _____. (The Titanium Alloy Manufacturing Co.). Preparation of Zirconium Dioxide. United States Patent 2,387,046, Oct. 16, 1945.

617. _____. (The Titanium Alloy Manufacturing Co.). Coordinated Zirconyl and Hafnyl Compounds and Their Production. United States Patent 2,424,262, July 22, 1947.

618. _____. (National Lead Co.). Antiperspirant Composition. United States Patent 2,507,128, May 9, 1950.

See also Nos. 312-318.

619. WAINER, E., AND HAKE, D. S. (The Titanium Alloy Manufacturing Co.). Refractory and Method of Making the Same. United States Patent 2,267,772, Dec. 30, 1941.

620. WAINER, E., AND van MATER, H. L. (The Titanium Alloy Manufacturing Co.). Zirconium Lakes and Method of Making Same. United States Patent 2,452,616, Nov. 2, 1948.

Generated on 2024-09-20 18:01 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

WALSH, K. A. See Nos. 632, 633.

621. WALTER, F. Projector Device. United States Patent 2,335,326, Nov. 30, 1943.

622. WEBER, L. J. (Aluminum Company of America.). Aluminum Alloys. United States Patent 1,932,835, Oct. 31, 1933.

WEIL, H. See No. 252.

WEINRICH, A. R. See No. 95.

623. WEISBERG, S. M., CHAPPELL, F. L., STRINGER, W. E., STEVENS, S., AND TREBLER, H. A. (Sealtest System Laboratories, Inc.). Process of Making Lactate Salts and Lactic Acid. United States Patent 2,071,368, Feb. 23, 1937.

624. WEISS, L. Process for the Manufacture of Opacifiers. United States Patent 1,881,303, Oct. 4, 1932.

625. WEIZMANN, C., AND BLUMENFELD, J. Improvements Relating to the Treatment of Solutions for the Separation of Suspended Matter. British Patent 228,814, Aug. 3, 1923.

WELCH, E. B. See No. 98.

626. WENTWORTH, C. (Radio Corporation of America). High Dielectric Materials and Method of Producing Them. United States Patent 2,529,719, Nov. 14, 1950.

627. WHITE, J. E. (Westinghouse Electric Corp.). Mercury Vapor Tube. United States Patent 2,431,152, Nov. 18, 1947.

628. WHITMAN, H. L. Vitrifying Refractory Composition and Product. United States Patent 2,534,327, Dec. 19, 1950.

629. _____. Vitrifying Refractory Composition and Product. United States Patent 2,534,328, Dec. 19, 1950.

WHITTEMORE, O. J., JR. See No. 382.

630. WIDELL, E. G. (Radio Corporation of America). Zirconium Coatings for Electron Discharge Devices. Canadian Patent 495,098, Aug. 4, 1953.

631. WIEGAND, E. L. Process of Classification and Separation of Material Particles. United States Patent 2,235,305, Mar. 18, 1941.

WIGGS, J. W. See No. 241.

632. WILHELM, H. A., AND WALSH, K. A. (United States of America as represented by the United States Atomic Energy Commission). Method of Producing Zirconium Tetrafluoride. United States Patent 2,602,725, July 8, 1952.

633. _____. (United States of America as represented by the United States Atomic Energy Commission). Preparation of Zirconium Tetrafluoride. United States Patent 2,635,037, Apr. 14, 1953.

Generated on 2024-09-20 18:05 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

WILSON, J. B. See Nos. 33, 34, 265, 266.

634. WINGFOOT CORPORATION. Vinyl Halide Polymer and Copolymer Stabilization. British Patent 584,674, Jan. 21, 1947.

635. WINTER, C. H., JR. (E. I. du Pont de Nemours & Co.). Production of Metals. United States Patent 2,607,674, Aug. 19, 1952.

636. WOECKEL, E. /Allgemeine Elektricitats-Gesellschaft). (Method for Application of a Coating of Zircon and/or Columbium Carbides or a Coating of an Admixture of These Carbides With Tantalum Carbide to Non-Emissive Electrodes./ German Patent 715,156, Dec. 16, 1941.

637. WOLFRAM AND MOLYBDAEN, A.-G. /Method of Making Hard Containers With Known Mixtures of Hard Carbides - W+Mo./ French Patent 749,190, July 20, 1933.

638. WOODCOCK, J., AND PARIDGE, J. K. (Steatite & Porcelain Products Ltd.). Improvements in or Relating to Ceramic Dielectrics Comprising Essentially Titania. British Patent 635,746, Apr. 12, 1950.

639. _____. (Steatite & Porcelain Products Ltd.). Ceramic Insulating Bodies and Method of Making. United States Patent 2,541,140, Feb. 13, 1951.

640. WOODRUFF, J. C., AND BLOOMFIELD, G. (Commercial Sovents Corp.). Improvement in Catalysts for Synthetic Methanol Production. British Patent 279,378, Sept. 20, 1928.

641. WORKMAN, A. R. (Cities Service Oil Co.). Manufacture of Butadiene From Propene and Formaldehyde. United States Patent 2,412,762, Dec. 17, 1946.

YERKES, L. A. See No. 495.

YORK, H. H. See No. 158.

642. YORK, H. H., AND DUMMETT, W. M. Improvements in the Manufacture of Refractories. Australian Patent 117,668, Oct. 21, 1943.

643. _____. Refractory Coating Material. United States Patent 2,390,765, Dec. 11, 1945.

644. ZIMMERMAN, G. B. (Universal Oil Products Co.). Production of High Anti-knock Fuel. United States Patent 2,404,340, July 16, 1946.

645. ZIRCON RUTILE LIMITED. /Process for Treatment of Zirconium Minerals and Associated Sands - Ilmenite, Rare Earths./ French Patent 779,515, Apr. 8, 1935.

Generated on 2024-09-20 18:53 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

Digitized by Google

Original from
THE OHIO STATE UNIVERSITY

SUBJECT INDEX

A

Absorptiometric determination, zirconium in magnesium alloys - 576
Absorption, K, discontinuities of the elements zirconium to iodine - 749
Abundance ratios, hafnium-zirconium ores - 129
Acetyl chloride, reaction with zirconium - 68
Acidity, basicity in glass - 870
  determination of - 212
Additives. See Alloys.
Adhesion, frictional, metal to glass, quartz and ceramic surfaces - 48
Agitator unit - 33
Alcohols, decomposition, catalysts, silica-alumina-zirconia - 441
Alizarin, for colorimetric determination of zirconium - 875
Alkoxides, zirconium and hafnium - 70
  zirconium, preparation of - 69
Allotropic transformation, in titanium-zirconium alloys - 183
Allotropic transitions, in zirconium alloys - 691
Alloys, aluminum, determination of zirconium in - 674
   grain refinement of - 166, 188
   pure, effect of zirconium in - 349
  aluminum-zirconium, equilibrium of - 217
   grain refinement of - 117, 188
  beryllia-alumina-zirconia, porcelains of - 518
  beryllium-copper, determination of zirconium in - 37
  beryllium-zirconium - 734
   metallography of - 897
  binary, systems, intermediate phases of - 692
  brazing, for metallic on nonmetallic materials - 681
  chromium steel, use of zirconium sulfides in - 673
  Chromium-zirconium, constitution diagran of - 589
  Copper, use of zirconium as hardening agent in - 125
  Copper-aluminum, effect of zirconium on - 64
  Copper-base, oxidation and scaling of - 896
  Copper-nickel-zirconium-aluminum, precipitation hardening of - 648
  Copper-zirconium, metal mold reactions of - 757
  Copper-zirconium system, constitution diagrams of - 5, 22
  deformation of - 902
  iron, white cast, zirconium as deoxidizer - 379, 380
  iron-carbon system, eutectoid in - 804
  iron-zirconium, physical properties of - 5
  lead-bismuth, liquid, use of zirconium with - 808
  magnesium, absorptiometric determination of zirconium in - 576
   method for introduction of zirconium in - 668
  magnesium-base, stress corrosion of - 550, 688
  magnesium-cerium, use of zirconium on - 639
  magnesium oxide-zirconium oxide-silicon dioxide, ternary system - 227
  magnesium-rare-earth-zirconium, heat treatment of - 679
  magnesium-thorium, effect of zirconium on - 531
  magnesium-thorium-cerium, effect of zirconium on - 531
  magnesium-thorium-zirconium, development of - 169

Generated on 2024-09-20 18:06 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Alloys
magnesium-zinc, corrosion of - 728
magnesium-zinc-zirconium, corrosion of - 728
heat treatment of - 679
uses for - 228
magnesium-zirconium - 85, 148, 194, 442, 668, 747, 907
casting of - 869
constitution diagrams of - 773
creep resistance of - 677
development of - 947
effect of phosphorous on - 195
high strength of - 596
hot working of - 948
metallurgy of - 582
nonmetallic inclusions in - 194
production and fabrication of - 85, 595, 616, 907, 922, 951
properties of - 34, 598, 747
properties of powder extruded - 170-173
magnesium-zirconium-zinc-thorium, casting of - 605
magnetic properties of - 6, 302
mechanical properties of - 547, 603, 690
metal-ceramic interactions of - 653-656
molybdenum, in zirconium - 795
nickel-silicon bronze, use of zirconium in - 397
nickel-zirconium, equilibrium diagram system of - 17
physical properties of - 5
niobium, in zirconium - 795
oxidation-resistant properties - 547
oxygen diluted in zirconium, physical properties of - 894
physical properties of - 5, 603
silver-zirconium, analysis of - 618
Steel, determination of zirconium in - 254
electrolytic determination of zirconium in - 461
steel and iron, substitution of zirconium for manganese in - 24, 26, 451
use of zirconium in - 24, 25, 339, 406, 867
titanium-zirconium, allotropic transformation in - 183
mechanical properties and microstructure - 155
titanium-zirconium oxide, for coating materials - 783
tungsten, carbide-free - 480
zirconium, allotropic transition - 691
alloyed to magnesium - 769
analysis of - 21
arc-melting furnaces for - 400
constitution of - 691
corrosion of - 203, 261, 495, 779
ductile, properties of - 899
effects on pure aluminum - 349
effect on steel hardenability - 138, 301
electrical and magnetic properties - 6
fabrication - 901
for nuclear reactors - 200
general discussion - 548
magnet properties - 302
metallography of - 735
metallurgy of - 924

Generated on 2024-09-20 18:12 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Alloys
zirconium, permanent magnet properties - 302
physical properties - 5
properties - 549
pure, preparation - 959
zirconium-aluminum, phase diagram of - 588
zirconium-base, casting of - 52
development and production of - 381-396
zirconium-beryllium, compositions - 358
structure - 32
zirconium borides, binary phase of - 75
zirconium-boron, binary - 481
zirconium-chromium, phase diagram of - 369
zirconium-copper, phase diagram of - 554
zirconium-hafnium, equilibrium diagram of - 207
zirconium-hydrogen, stability of - 789
zirconium-iron, constitution and mechanical properties of - 370
zirconium-magnesium, production of, by powder metallurgy - 357
zirconium-manganese, phase diagrams of - 737
zirconium-molybdenum, structure of - 184
system - 168
zirconium-nickel, phase diagram of - 371
zirconium oxide films formed on - 405
zirconium-oxygen, melting point-composition diagram - 140
zirconium-tin, effect of hydrogen on mechanical properties of - 637
zirconium-titanium, transition point diagram of - 210
zirconium-solfram, system - 168
zirconium-zirconium oxide, for coating materials - 783
Aluminon, for detecting zirconium - 609
Aluminum, in zirconium, determination - 233
separation from ores - 91
Aluminum alloys, determination of zirconium in - 674
colorimetric determination of, in zirconium - 87
determination of, in zirconium - 233
Effect of zirconium on - 349
Aluminum-zirconium alloys, equilibrium of - 217
grain refinement of - 117, 166, 188
Amalgam metallurgy, for production of zirconium - 557
Amberlite resin absorbent, removal of zirconium from - 427
Ammonium ions, detecting potassium by zirconium sulfate in presence of - 723
Amperometric titrations - 497
Analysis - 198
Aluminon, for detecting zirconium - 609
Chemical, of zirconium - 110, 645, 781, 906
uranium-zirconium alloys - 617
zirconium dioxide - 446
ferrozirconium and zirconium in steel - 215
fission products - 889
formation current, electrolytic oxidation of zirconium, 697
inorganic, chromotrographic methods of - 696
microscopic, of zirconium and hafnium - 911
nonmetallic residues, alcoholic iodine method - 849
quantitative - 193, 662, 699
radiochemical activity - 428, 925
silver-zirconium alloys - 618

Generated on 2024-09-20 18:06 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Analysis
spectrochemical, of hafnium, zirconium, and their compounds - 128, 254, 641, 833
spectrographic, of hafnium, zirconium, and their compounds - 241, 389, 635, 752, 832
X-ray diffraction, unit for - 671
zircon, 80, 498
zirconium, for hafnium content - 698, 832
its compounds, minerals, and alloys - 80, 498, 701, 781
use of organic reagents for - 700
zirconium-rich binary alloys - 389
See also Determinations.
Anhydrous fluorides, preparation - 552
Anion exchange - 224, 955
chloro-ions - 420
fluo-ions - 421
Anion exchange separation, zirconium and hafnium - 422
zirconium and hafnium - 500
zirconium complexes - 928
Annealing - 45, 62
effect on zircon body - 153
Anodic polarization - 566, 625-630
Anodizing - 619, 620
Antiferroelectric structure, of lead zirconate - 771
Antiferroelectricity, in lead zirconate - 770
Aqueous chemistry - 126
Aqueous fission products, coseparation with manganese dioxide - 250
Aqueous fluozirconate ion, coseparation with solid lanthanum fluoride - 249
Arc melting - 152
reactive metals - 559
refractory metals and alloys of zirconium - 400
zirconium with tungsten electrode - 252
Aromatic acids, inhibitory effect of - 490
Atomic energy, interval formula for multiplets of - 16
Atomic masses - 160
Atomic power - 36, 454, 455, 496, 611, 623, 624, 736, 798, 968
Atomic research - 36, 797
Atomic spectra of zirconium - 587
Atomic weights - 41, 401, 916
Atoms, stable, determination of - 514
Australia, chemical engineering research in - 113
deposits of zircon in - 109, 599
zircon production figures in - 710

B

Ball milling - 782
Barium-hydrogen system, stability - 789
Barium-lead zirconate, dielectric properties - 741
Beryl phosphate bodies, physical properties - 685
Beryllia-alumina-zirconia, porcelains, properties - 518
Beryllium, processing and property data - 734
separation from ores - 91
Beryllium-copper alloys, analysis of zirconium in - 37
zirconium alloys, metallography of - 897
zirconium system - 734

Generated on 2024-09-20 18:10 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Beta decay - 809
particles - 189
Beta energies, radiations - 462
spectrometric determination - 666
zirconium and columbium - 621
Binary system, zirconium-boron - 75, 481
Binary metal alloy systems, intermediate phases, investigation - 692
Bonding metal to glass - 49
zircon, use of, in sand-mold paints - 46
Borides, preparation and properties of - 863
refractory, binary systems of - 75
zirconium, metallographic preparation of - 927
properties, fabrication and preparation of - 336
sintering of - 256
Borohydrides, zirconium, preparation and properties of - 407
Brazil, occurrence of zircon in - 230, 255
Brazing - 777
metal to nonmetallic zirconium - 681
to join nonmetallic materials to metals - 680
zirconium, for surface preparation - 778
Bromides, anhydrous, preparation and properties of - 960, 962
Butadiene, from ethyl alcohol, utilizing zirconium catalysts - 131

C

Calcium determination, using flame photometry - 376
Carbides - 431
zirconium, for thermionic emitter use - 328
sintering of - 534
vapor pressure data - 570
Carbon, in zirconium, determination - 687
Carbon monoxide, oxidation, zirconium oxide coactivator - 464
Carbonate, zirconium, toxicity of - 350
Cast 25 percent chromium - 12 percent nickel alloys, strength and ductility - 301
Casting and castings - 52, 505, 511, 596
magnesium-zirconium alloys - 907
zirconium-base alloys - 385
Catalysis, in fused salt systems - 649
of ethyl alcohol, to produce butadiene - 131
Catalysts, chemical properties of - 615
copper-zirconium phosphate, use in oxidation of phosphorus - 377
cracking, chemistry of - 881
spectrographic analyses of, in determination of zirconium - 241
Friedel-Crafts, zirconium tetrafluoride with aluminum chloride - 378
properties - 935
silica-alumina-zirconia - 441, 740
zirconia, for aromatization of n-heptane - 211
zirconium, in vapor phase esterification - 234, 493
to produce butadiene from ethyl alcohol - 131
Cathodic polarization - 625, 626, 627, 628, 630
Cation exchange methods, for separating zirconium and hafnium - 543
Cationic group, chemical compounds of insecticidal efficiency, toxicity of - 231
Ceramics - 560, 561, 683, 790
interaction with metals, study - 653-656
uses - 758
See also Refractory materials, element, or special subject.

Generated on 2024-09-20 18:07 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Ceramic bodies, dielectrics, thermal shock, behavior - 836
  strength and creep characteristics - 86
  properties of - 494
Ceramic shapes, fabrication - 638
Cerium nitrate, extraction, by butyl phosphate - 931
Cerium, oxide sulfides, discussion - 187
Cermets, development - 683, 790
Chemical agents, zirconium oxide, effect on hydration rate of fired quick-lime - 93
Chemical compounds, insecticidal value, toxicity - 231
Chemisorption - 892
Chemistry, analytical, of zirconium - 110, 645, 781, 906
  aqueous - 126
  crystal - 361
  solution, of zirconium - 544
Chloranilate complexes, zirconium - 876
Chlorides, metallic effect on tumor and nontumor tissues - 873
  of elements, free energies of formation, survey - 257
  zirconium, purification of - 916
   reduction of - 435
Chloride alkoxides, zirconium, action of alcohol - 67
  hydrosols, pH values of - 879
Chlorination, decomposition of zircon by - 2
  zircon oxide - 864
Chlorine, determination of - 916
Chromatography - 696, 955
Chromium, heat capacities - 198
Chromium-steel alloys, use of zirconium sulfides in - 673
Chromium-zirconium system, constitutional diagram of - 589
Citrates, zirconium, effect on blood level distribution and excretion of radiolead - 786.
   for treating plutonium and radioyttrium poisoning - 784
   injections, effect on distribution of plutonium - 327
Coagulation, concentrated sols of zirconium - 705
Coatings, anodic - 619
  ceramic - 683
  electrodeposition from nonaqueous solutions - 591
  high-temperature - 103
  high-vacuum techniques - 260
  metal-ceramic combinations, zirconium-zirconium oxide and titanium zirconium oxide - 783
  metal to glass, frictional adhesion of - 48, 49
  properties - 375
Cold-worked metals, annealing - 45
Colorado pitchblende, zirconia content, investigation - 232
Colorimetric determination, of zirconium - 308, 483
Colorimetrical behavior, of zirconium - 449
Columbates, zirconium, thermal expansion of - 181
Columbium (niobium), activities, notes - 448
  activity in fission, determination - 258
  alloys in zirconium - 795
  as engineering material - 202
  radioactive, from uranium - 313
  removal from amberlite resin adsorbent - 427
  separation from zirconium, quantitative - 4

Generated on 2024-09-20 18:04 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Combustion - 314
  zirconium powder, control of factors in - 13
Compounds
  complex inorganic, containing polydentate groups - 456
  See also specific element
Compression measurement, various substances - 78
Concretes, for pile shielding, use of zirconium in - 841
Condenser, fluidized - 44
Conductivity. See Electrical conductivity.
Constitution diagrams
  Chromium-zirconium system - 589
  Copper-zirconium system - 22
  Magnesium-zirconium - 773
  Zirconium alloys - 691
  Zirconium-iron system - 370
  See also Alloys, Phase diagrams, and Systems.
Copper alloys, use of zirconium as hardening agent in - 125
Copper-aluminum alloys, effect of zirconium on - 64
Copper-base alloys, oxidation and scaling of - 896
Copper-nickel-zirconium-aluminum, precipitation hardening of - 648
Copper-zirconium alloys, metal mold reactions of - 757
  properties, chemical and magnetic - 6
Copper-zirconium system, constitution diagram of - 5, 22
Corrosion - 74, 243, 264-295
  galvanic, behavior in sulfuric acid solutions - 779
  magnesium-zinc alloy - 728
  properties - 602, 945
  resistance - 222, 261, 517, 689, 874, 898, 901
   effect of oxygen, nitrogen, carbon, and hafnium on - 83
   magnesium-zirconium alloys, effect of phosphorus on - 195
   zirconium - 263
  resistant materials - 855
  Stress, magnesium-base alloys - 550, 688
  zirconium - 718-721, 956
   development of low-resistance oxide layers - 621
   formation of anodic coatings on, relation to factors affecting - 619
Creep characteristics, zirconium - 84
  ceramic bodies - 86
Creep resistance, magnesium-zirconium alloys - 677
Crucibles, preparation - 226
  zirconia, preparation - 942
Crystal analysis, results - 914
  chemistry - 361
  modifications of zirconia - 121
  structure, beta-zirconium - 88
   zirconium - 425
   zirconium boride - 702
   zirconium hydride - 753
   zirconium oxide - 150
   zirconium oxysulfide - 580
Crystal bar zirconium, cold rolled and annealed, texture - 392
  endurance limit - 930
Crystalline arsenates of zirconium and hafnium - 324
Crystalline powders, immersion in water and organic liquids, energy - 66

Generated on 2024-09-20 18:10 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Crystallography - 586
  neutron - 877
  zirconium - 585
Crystals and molecules, electronic structure - 204
  growing - 101
  zirconium, preparation - 777
Cupferrates, extraction - 236
Cupferron, for quantitive analysis of zirconium - 80
Cytological reaction, Allium Cepa, treatment with zirconium - 532

D

Density, zirconium oxides - 403
  hafnium and zirconium - 60
Deoxidizers, zirconium, effect on steel- 139
   for steel - 824
   in white cast iron - 379, 380
Deposits - 597, 607, 884
  Australia, zircon - 109, 599
  Brazil, zircon - 230, 255
  England, heavy mineral beach sands - 457
  Florida, nonmetallic mineral resources - 307
  Colorado, pitchblende containing zirconia - 232
  Germany, zirconium production - 704
  Greenland, zircon - 440
  Idaho, zircon - 526
  India, refractory minerals - 712
  New Zealand, hafnium discovery - 799
  Oregon, beach sands, ore dressing, ilmenite and zircon - 149
  Tanganyika, hafnium - 843
Determination, absorptiometric of zirconium, in magnesium alloys, iron, steel, and minerals - 576
  aluminum in zirconium - 87, 233
  carbon in zirconium - 687
  colorimetric, zirconium and hafnium - 308, 483, 535
  electrolytic, zirconium, in steels and alloys - 461
  ferrozirconium and zirconium in steel - 215
  fluorine in zirconium metal - 151
  fluorometric, of zirconium in minerals - 3
  iron in zirconium - 28
  melting point diagram, zirconia-silica system - 933
  nickel in zirconium - 43
  nitrogen in zirconium - 745
  oxides of zirconium in alumina - 754
  oxygen in zirconium - 488, 717, 854, 885
  photometric, zirconium - 939
  polarographic, polarization curves for oxygen reduction of metals - 158
   zirconium - 304
  radioactivation, zirconium-hafnium mixtures - 418
  spectrochemical, hafnium-zirconium ratios - 214
  spectrographic, hafnium and zirconium - 634
  spectrometric, beta particles - 666
  spectrophotometric, elements and metals in zirconium - 42, 98, 414, 479
  thorium in zirconium - 311
  tin in zirconium, solid solubility - 847

Generated on 2024-09-20 18:54 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Determination
vapor pressure, zirconium and hafnium in tetrachloride - 120
zirconium, activity in fission - 934
by aluminon - 609
by arsenate method - 787
by precipitating from homogeneous solutions - 950
by precipitating with p-dimethylaminoazophenylarsonic acid - 860
in aluminum alloys - 674
in lanthanum solutions - 429
in ores, minerals, and refractories - 410, 553, 823
in phosphate rock samples - 932
in presence of interfering elements - 512
in steels - 142, 143, 244, 374, 491, 821, 822
in surface area - 196
in uranium - 320
in zirconium fluoride - 581
radioactive - 533
spectrographic analysis of cracked catalysts - 241
with alizarin - 875
with mandelic acid - 331, 664
with phenylarsonic acid - 733
with p-hydroxphenylarsonic acid - 820
with propylarsonic acid - 18
with reagent m-cresoxyacetic acid - 920
zirconium activities in fission - 72, 258, 426, 463
zirconium-hafnium, in columbium - 434
ratio in oxychlorides - 940
ratios with p-bromomandelic acid - 332
Deuterium, substitute for hydrogen atoms, effect on hafnium dihydride - 819
Dielectric properties, lead zirconate and barium-lead zirconate - 741
Dielectrics, zircon - 837
Diffraction, neutron - 812
Diffusion - 563
Diffusion constants - 182
Dioxide, hafnium, heat contents and entropies of - 667
zirconium, purification - 446
X-ray diffraction studies of - 119
Diphenyldinitrogen zirconium, preparation - 238
Disintegration of zirconium and niobium - 828
Dissociation studies, zirconium, using mass spectrometer - 825
pressures of zirconium hydride - 192
Dissolution, zirconium, in hydrofluoric acid - 40
Drawing, zirconium wire - 89
Ductile zirconium, fabrication and mechanical properties - 7, 365
production - 366, 503, 504, 899
Dust, metal-powder, explosibility - 351-354
zircon, inhalation - 348

E

Economics, zirconium - 607
Elastic constant - 732
Electrical conductivity - 356
properties of alloys - 6
properties of thin oxide films of zirconium - 107

Generated on 2024-09-20 18:02 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Electrical conductivity
  resistance, high-purity zirconium - 96, 739
   transition metals - 703
Electrochemical polarization, zirconium, in sodium chloride solution - 326
Electrochemistry - 594
Electrodeposition - 591
  zirconium, from fused salts - 475, 694
   from solution - 411
Electrodes, for arc-melting zirconium - 252
   graphite, heat loss with various types - 510
  zirconium - 100
Electrolytes - 100
Electrolytic oxidation of zirconium, analysis of formation current in - 697
  determination of zirconium in steels and alloys - 461
Electrolytic separation, zirconium - 693
Electron, currents, flow in thin films of zirconium oxide - 106
  configuration, in metallic zirconium, change - 852
  emission, tungsten filaments - 182
  energies, conversion - 666
  tubes, effect of gas absorption power of zirconium on - 424
Electronics - 238
Electroplating on zirconium - 775, 776
Electrostatic separation of zircon - 229, 467
Embrittlement - 262
Embrittling gases - 539
Emission phenomena - 182
Enamels, effect of zirconium on, as opacifying agent - 487
  Addition of zirconia to, for sheet steel - 958
England, heavy mineral beach sands - 457
Enthalpies - 722
Entropies, zirconium and hafnium and their compounds - 472, 667, 886, 887
Equilibrium, aluminum-zirconium - 217
  between zirconium oxide and carbon - 706
  diagram, nickel-zirconium system - 17
   phase zirconium-chromium - 750
   zirconium-hafnium - 207
  phases, uranium dioxide-zirconium oxide system - 516
Etchants - 62
Expansion coefficients of zirconium - 756
Explosibility, metal powders and dusts - 351-354
Extractive metallurgy, zirconium, by fused salt electrolysis - 713
Extrusion process - 197

F

Fatigue properties, zirconium - 801
Ferrocyanide, for separation of zirconium and hafnium - 788
Ferroelectricity, in lead zirconate - 770
Ferrozirconium and zirconium, in steel analysis - 215
Fission products - 317
  aqueous, coseparation - 250
  zirconium in, determination - 258
  isotope of zirconium - 296
  raw, separation; procedure - 343, 344
Fission yields, zirconium - 132

Generated on 2024-09-20 18:06 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Float melting, in electromagnetic field - 27
Florida, nonmetallic mineral resources - 893
Flotation, zircon - 112
Fluo-ions, anion exchange of - 421
Fluorides, anhydrous, preparation from oxides - 552
  effect, on gravimetric determination of zirconium in zirconium fluoride - 581
  metallurgical reactions - 474
  of elements, free energies of formation, survey - 257
  zirconium, preparation - 957
Fluorine, in zirconium, determination - 151
Fluozirconate, aqueous, coseparation - 249
Fluxing and alloying technique, magnesium-zirconium alloys - 951
Fractional distillation, separation of hafnium and zirconium - 316
Fractional separation, zirconium and hafnium - 219
Free energies of formation - 257, 474
Free energy functions - 527
Frictional adhesion, metal to glass, quartz, or ceramic surfaces - 48
Furnace tubes, zircon, for high vacuum systems - 322
Furnaces, arc-melting, for zirconium alloys - 400
  Consumable-electrode arc melting, production model - 865
  electric arc, for producing fused stabilized zirconium - 568
  electric, for producing zirkite - 882
  for producing zirconium-base alloys - 381-383, 385
  lining, zircon for - 123
  quenching, use for system zirconium oxide-titanium oxide and zirconium oxide-silicon dioxide - 845
  surface combustion, construction and testing - 76
  vacuum, for degassing raw materials of zirconium-base alloys - 383
Fused salt electrolysis, for preparation and production of zirconium - 541, 713 813-818
Fusion, flash, tests for minerals - 415

G

Gamma energies, zirconium and niobium - 621
Gamma radiations - 565
  from neutron excitation - 562
Gamma rays, nuclear, correlation measurements on - 946
Gases, chemisorption of - 892
  reactions with metals - 141
Gas-metal reactions, zirconium - 321
Gas-phase reactions, zirconium - 528
Gas-turbine blades, effect of zircon and titanium carbide on performance - 408
Gelation, compared with coagulation - 705
Geochemistry, Swiss lavas - 12
Geology, economic - 597
Germanium, abnormal diamagnetism at low temperatures - 851
Germany, zirconium, production - 704
  titanium, production - 704
Gettering powers, zirconium, for various gases - 191
Glass, applying metal to - 49
  borosilicate, effect of zirconia on chemical durability - 412

Generated on 2024-09-20 18:07 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Glass
  frictional adhesion of metal to - 48
  effect of zirconium on - 487
  melts in system zirconia-alumina-silica - 31
  soda-lime, effect of zirconia on - 413
Glazes, effect of zirconium and titanium on - 486
  effect of zirconium oxide on, 398, 487
  high-fire opaque, for zircon - 909
  for zircon porcelain - 555
Grain-growth, in zirconium - 180
Grain-growth inhibitors, in steel, effects - 340, 341
Greenland, zircon minerals in - 440

H

Hafnium, Alizarin lake, spectrophotometry of - 536
  aqueous solutions, electrolytic studies - 310
  anion exchange separation - 422
  as engineering material - 202
  atomic weight - 401
  behavior, compared with zirconium - 111
  chemistry - 259, 906
  colorimetric determination - 535
  complexes, physical properties - 315
  complex chloro-ions, anion exchange - 420
  concentrate, production - 447
  determination, in zirconium - 634, 698, 751
  discovery - 134-136
   New Zealand sand - 799
  extraction from nitric acid solutions - 579
  fluo-ions of, anion exchange - 421
  fission activities - 463
  fractional separation, by entraction with thenoyltrifluoroacetone - 419
  general survey - 201, 551
  heat capacities - 667, 886
  isotopes - 731
  mineralogy - 530
  occurrences, Tanganyika - 843
  optical properties - 590
  present status - 926
  purification - 844
  separation - 923
   fractional distillation, with phosphorus oxychloride complexes - 316
   from zirconium, cation exchange method - 543
    ferrocyanide method - 778
    fractional - 219, 419, 524, 949
    Hillebrand method - 81
    ion exchange method - 82, 478, 646
  spectrum and wave length - 593
  use - 572
Hafnium dihydride, hydrogen bond distances in, deuterim effect on - 819
Hafnium dioxide, high-temperature heat contents - 667, 886
Hafnium-free zirconium, preparation - 310
Hafnium ions, isotopic constitution - 161
Hafnium nitride, heats of formation - 433

Generated on 2024-09-20 18:02 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Hafnium oxide, heats of formation - 433
monoclinic, X-ray power diffraction data - 247
Hafnium tetrachloride, high-temperature heat contents - 667, 886
with phosphorus oxyhalogen compounds, addition compounds - 523
Hafnium to zirconium, abundance ratios - 129
Hardenability, steel, effect of zirconium on - 138
steel containing zirconium, effect of nitrogen - 163
Harndess properties, crystal bar zirconium - 930
zirconium, effect of oxygen on - 893
Health See Medical.
Heat resistance - 372, 855
Heat transfer rates, zirconia - 145
Heats of formation, hafnium oxide and hafnium nitride - 433
zirconium tetrachlorides - 432
High-temperature applications - 52, 111, 205, 206, 329, 560, 561, 603, 608, 675, 676, 683, 790, 855
Humphrey's spiral concentrator, for ore dressing - 417
Hydration, fired quicklime, effect of zirconium oxide on rate - 93
Hydrides, zirconium, dissociation pressures of - 192
general discussion - 318
properties, preparation of - 318, 319
X-ray investigation of - 330
Hydrofluoric acid, dissolution of zirconium in - 701
Hydrogen, overvoltage - 625, 626
permeation through ductile zirconium sheet, rate - 54
Hydrolysis, zirconium, in perchloric acid solution - 127
zirconyl chloride and sulfate - 917
Hydrolytic polymerization - 499, 967
Hydrosals, zirconate, formation of - 880
zirconium, behavior of - 879

I

Idaho, zircon occurrence - 526
Inclusions, nonmetallic, metallographic identification of - 764
India, refractory minerals - 712
Injection molding - 53
Insulation, use of zircon for - 333, 767
Ion exchange separation - 82, 646, 848, 888
Ionic currents, in thin films of zirconium oxide - 107
Ionic migration to separate hafnium and zirconium - 478
Ionization studies, zirconium, using mass spectrometer - 825
Ions - 160, 809
effect on cracking catalysts - 615
hafnium, production - 161
zirconium, in aqueous solution - 127
Iron-carbon eutectoid, effect of zirconium on - 804
Iron, white cast, deoxidizers - 379, 380
malleablization, effect of zirconium on - 56
Iron-zirconium alloys, properties - 5, 6
Irradiation - 665, 828
Isotopes - 296, 438, 470, 941
electromagnetic enrichment - 469
electromagnetic separation - 825
hafnium - 19, 20, 731

Generated on 2024-09-20 18:02 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Isotopes
energy levels of - 423
biological investigation - 556
zirconium - 19, 20
exact masses - 711
from uranium fission - 312
preparation and study - 439
radioactive - 178
radiochemical studies on - 146
Isotopic constitution, hafnium ions - 161

K

Kroll process, ductile zirconium - 253, 503, 508, 866, 898, 900, 901
empirical study - 253

L

Lande rule, intervals of multiplets for atomic energy - 16
Lanthanum fluoride, solid, coseparation with aqueous fluozirconate ion - 249
Lattice constants, zirconium, effect of oxygen on - 893
Lead-bismuth liquid alloys, use of zirconium with - 808
Lead zirconate, antiferroelectric structure - 771
dielectric properties - 741
ferroelectricity versus antiferroelectricity - 771
piezoelectric effect on - 742
Liquid-liquid extraction, droplet behavior in packed columns - 242
Lithium, heat capacities - 722

M

Magnesia-beryllia-zirconia system, physical properties of porcelains and phase relationships - 519
Magnesium, heat capacities - 198
Magnesium alloys, light, use - 148
powder extruded, high strength properties - 170-173
Magnesium-base alloys, stress corrosion of - 550, 688
use of zirconium with - 947
working - 948
Magnesium-cerium alloys, use of zirconium on - 639
Magnesium oxide-zirconium oxide-silicon dioxide, ternary system, solid state reactions of - 227
Magnesium-rare earth-zirconium alloys, heat treatment - 679
Magnesium-thorium alloys, effect of zirconium on - 531
Magnesium-thorium-cerium alloys, effect of zirconium on - 531
Magnesium-zinc alloys, corrosion - 728
Magnesium-zinc-zirconium alloys, corrosion - 728
uses for, 228
Magnesium-zinc-zirconium alloys, heat treatment - 679
Magnesium-zirconium alloys - 21, 85, 170, 171, 172, 173, 194, 442, 576, 668, 747, 869
creep resistance - 677
effect of phosphorus on - 195
handling - 907
high strength of - 596

Generated on 2024-09-20 18:06 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Magnesium-zirconium alloys
metallurgy - 582
nonmetallic inclusions - 194
production and fabrication - 85, 595, 616, 907, 922, 951
properties - 34, 598
Magnesium-zirconium constitution diagram - 773
Magnesium-zirconium-zinc-thorium alloys - 605
Magnet alloys, permanent, investigations - 302
Magnetic properties, alloys - 6, 302
Magnetic susceptibilities, hafnium and zirconium - 502, 853
Malleablization, white cast iron, effect of zirconium on - 56
Mandelic acid, determination of zirconium - 664
reagent for determination of zirconium - 920
Manufacture. See Production and Processes.
Mass absorption coefficient - 537
Mass spectra, hafnium and zirconium - 19, 20
Packing-fraction differences - 305
M-cresoxyacetic acid, reagent for determining zirconium - 920
Measurements, compression - 78
magnetic and resistance - 852
Mechanical properties - 365, 538, 547, 572, 603, 690, 748
Dilute alloys of oxygen in zirconium - 894
zirconium-iron system - 370
zirconium-tin alloys, effect of hydrogen on - 637
Mechanical working - 209
Medical, analysis, biological, of fission products - 889
blood level, effect of zirconium citrates on distribution and excretion of injected radiolead - 786
cytological reactions of salt solutions - 532
D-amino acid oxidase, inhibited effect of aromatic acids - 490
distribution of plutonium in rats, effect of zirconium citrate injections on - 327
fission products, metabolism - 343, 344, 466, 800
growth of tumor and nontumor tissue, effect of metallic chlorides on - 873
hafnium complexes for biological investigation - 556
metabolic properties - 342
flutonium and radioyttrium poisoning by zirconium citrate, treatment - 784
radiographic shadows, produced by inhaling industrial dusts (zircon) - 348
zirconium, use in operating room - 39
zirconium and zirconium compounds, toxicity of - 903, 904, 905
zirconium carbonate, toxicity - 350
Melting - 459, 505
arc - 152
consumable electrodes of zirconium - 252, 865
refractory metals and alloys of zirconium - 400
float, of metals in containers - 27
inductive, of reactive metals - 559
magnesium-zirconium alloys - 907
zirconium-base alloys - 383, 384, 387
Melting points, metallic carbides and nitrides - 431
refractory oxides - 515
Melting point-composition diagram, zirconium-oxygen system - 140
Melting point diagram, system zirconia-silica - 933
Metabolic properties - 342
Metabolism, fission products - 343, 344, 466, 800

Generated on 2024-09-20 18:02 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Metals, analysis, procedures - 110
  new, in atomic energy - 455
  rare, uses - 640
Metal-ceramic combinations, coatings, titanium-zirconium oxide and zirconium-zirconium oxide - 783
  wettability - 485
Metal-ceramic interactions - 430, 653-656
Metal films, evaporation in gas chemisorption - 892
Metal crystals, large, gorwing - 101
Metallographic identification, inclusions in zirconium - 764
Metallography - 368, 765
  attack-polish method - 606
  beryllium-zirconium alloys - 897
  color, of zirconium - 223
  zirconium and zirconium alloys - 735
  zirconium, perchloric-acetic electrolytic method - 751
Metallurgy - 29, 373, 507, 601, 602, 604, 924 (See also special subjects)
Metals, deformation - 902
Microscopic studies, zirconium oxide, silicate melts - 35
Microstructure, zirconium - 930
Milling, zirconia ball - 782
Mineral dressing. See Ore dressing.
Mineralogy, hafnium - 530
Minerals, determination of zirconium in - 410
  flash fusion tests for - 415
  occurrences of zirconium in - 248, 465, 964
  radioactivity and coloration - 644
  zircon, deposits on Brazilian coast - 255
Molding, injection - 53
Molecules and crystals, electronic structure - 204
Molybdenum, as engineering material - 202
  use - 572
Molybdenum and columbium (niobium) alloys, in zirconium - 796

N

Neutrons - 97, 448, 828
  cross sections - 122, 643, 803
  zirconium and hafnium, 190
  crystallography - 877
  data - 213
  diffraction - 812
  excitation - 562
  velocity - 362
New Zealand, hafnium discovery - 799
Nickel-silicon bronze alloys, use of zirconium in - 397
Nickel-zirconium, equilibrium diagram - 17
Nickel-zirconium alloys, properties - 5, 6
Niobium. See Columbium.
Nitrides - 431
  hafnium, heats of formation of - 433
  zirconium, for conducting elements - 92
   heat capacities and entropies of - 887
   preparation and properties - 337
Nitriding - 862

Generated on 2024-09-20 18:02 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Nitrogen, in zirconium, determination - 745
effect on corrosion resistance - 83
in steels containing zirconium, influence on hardenability - 163
influence on transition of zirconium - 157
with beta zirconium, surface reaction - 564
Nonaqueous melts - electrochemistry of - 594
Nuclear gamma rays, correlation measurements on - 946
Nuclear power plants, operation - 698
use of zirconium in, 454, 496, 611, 738, 806
Nuclear reactors, zirconium for - 139, 221
Nuclear transmutations - 514

O

Occurrences See Deposits.
Opacifier, zirconium oxide, solubility in glass - 15
Opacifying agents, effect of zirconium on glasses, glazes, and enamels - 487
Opacity, measurement, during coagulation of concentrated sols of zirconium - 705
Optical properties, zirconium and hafnium tetrafluorides - 590
Optical ratio, solutions containing hafnium and zirconium oxychloride - 940
Optical studies, zircon - 633
Ore dressing, ilmenite and zircon, Oregon beach sands - 149
Ores, determination of zirconium in - 553, 823
Organometallic compounds, zirconium - 458
Orientation, preferred, zirconium - 584
Oxalate, zirconium, preparation - 238
Oxidation, carbon monoxide, zirconium oxide coactivator - 464
copper-base alloys - 896
electrolytic, of zirconium, analysis of formation - 697
high-temperature - 205, 206
parabolic rates - 631
phosphorus, copper-zirconium pyrophosphate catalyst - 377
rates, determination - 578
zirconium hydrides - 14
Oxidation-resistant properties, alloys - 547
zirconium, in activated oxygen - 175
Oxides, addition, effect on thermal changes of zirconia - 245
films, formation on metals and alloys - 405
films, zirconium, ionic currents in - 107
hafnium, heats of formation of - 433
sublimed in electric arc, luminescence - 647
Oxidic substances, electrical double layer, study - 921
zirconium, ball milling - 50
behavior, in vacuo - 453
chlorination - 864
crystal structure - 150
freeing impurities - 118
thermal conductivity, measurement - 660
use in ceramics - 501
vapor pressure data - 570
zirconium and hafnium, density - 403
Oxide-sulfides, zirconium, preparation and properties - 187
Oxychloride, determination, zirconium-hafnium ratio of - 940
Oxygen, determination of, in zirconium - 488, 717, 854, 885
effect on lattice constants and hardness of zirconium - 893

Generated on 2024-09-20 18:05 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Oxygen
  evaluation, in zirconium - 542
  in zirconium, effect on corrosion resistance - 83
  influence on transition of zirconium - 157
  solid solutions, in metallic zirconium, electrolysis - 156
Oxygen alloys, dilute, in high-purity zirconium, physical and mechanical properties - 894
Oxysulfide, crystal structure - 580

P

Packed columns, droplet behavior in - 242
Particle accelerators, preparation of tritium-zirconium - 743
Partition, separation of zirconium and hafnium by - 218
Permeability, hydrogen - 54
Phase diagram - 770
  zirconium-aluminum system - 588
  zirconium-chromium - 369
  zirconium-copper - 554
  zirconium-manganese system - 737
  zirconium-molybdenum - 168
  zirconium-nickel system - 371
  zirconium oxide-calcium chloride system - 47
  zirconium tetrachloride-sodium chloride system - 47, 476
  zirconium-wolfram - 168
Phase relationships, magnesia-beryllia-zirconia system - 519
  zirconia ceria system - 185
  zirconium oxide-titanium dioxide and zirconium oxide-titanium dioxide-silicon dioxide - 846
Phosphate method, for determining zirconium in fission, compared with ovalate methods - 72
Photocurrents, in thin films - 106
Photodisintegration, thresholds for - 665
Photoelectric currents, flow in thin film of zirconium oxide - 106
Photoelectric work functions, action of oxygen, nitrogen, and hydrogen in lowering - 729
  zirconium, lowering - 730
Photometric determination, of zirconium - 939
Photometry, flame, for determing calcium - 376
Physical constants - 760
Physical properties - 572, 603
  high-purity zirconium - 894
  refractories - 868
  sintered zirconium - 460
  zirconia - 695
  zirconium and hafnium complexes - 315
  zirconium phosphate bodies - 685
Piezoelectric effect, lead zirconate - 742
Piezoelectric properties, zirconate - 839
Plastic properties - 176
Plutonium, metabolic properties - 342
Polarization, anodic - 566, 913
  anodic and cathodic - 625, 626, 627, 628, 629, 630
  curves, for oxygen reduction of metals, determination, polarographic method - 158
  electrochemical, of zirconium in neutral chloride - 326

Generated on 2024-09-20 18:09 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Polarography - 304, 913
of certain arsonic acids - 497
Polycrystalline metals, plastic properties - 176
Polymerization, hydrolytic - 127, 499, 967
zirconium, by extraction of zirconium chelate of thenoyltrifluoracetone into benzene - 127
Polymorphism, zirconia - 361
Porcelains, system beryllia-alumina-zirconia - 518
system magnesia-beryllia-thoria - 519
system magnesia-beryllia-zirconia - 519
thermal resistant - 838
use of zirconium in - 246
Potassium traces, detection, in zirconium - 726
detection with zirconium sulfate - 724, 727
Powder, zirconium processing - 108
Powder metallurgy - 345, 359, 360
Powder parts, production, new method - 345
Power plants, nuclear fueled - 496, 611, 698
Precipitants - 59
Precipitates, fumaric acid - 919
phthalic acid, reagent - 709
Precipitation - 497, 725
hardening, copper-nickel-zirconium-aluminum alloys - 648
hydrous zirconia - 57
metallic, of zirconium - 237
thorium, for determination in zirconium - 311
zirconium - 298, 304, 581, 860
for determination in steels - 142, 143
from homogeneous solutions - 950
in steel, using p-dimethylaminoazophenylarsonic acid - 374, 860
phosphate - 861
using mandelic acid - 331
zirconium and hafnium arsenates - 324
Preparation - 335
anhydrous fluorides - 552
borides - 863
general survey methods - 540
tritium-zirconium targets - 743
zirconia crucibles - 942
zirconium, by fused salt electrolysis - 418, 541, 813, 814, 815, 816, 817, 818
crystals - 77
ductile - 165
fused - 130
hafnium-free - 325
zirconium alkoxides - 69
zirconium alloys, pure - 959
zirconium and its compounds - 567
zirconium metal, pure, by vacuum sublimation of zirconium fluoride - 1
zirconium tetrafluoride - 953, 954
zirconium tetraiodide - 216
Purification - 30, 446, 672, 707, 900
zirconia and zirkite, in electric arc furnace - 568, 882
zirconium and hafnium - 844

Generated on 2024-09-20 18:55 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Q

Quartz, frictional adhesion of metal to - 48

R

Radiation - 189, 438, 462, 642, 811, 968
  alpha, damage in zircon - 437
  biological studies - 342
  disintegration of zirconium and columbium (niobium) - 828
  effect on zirconium - 335
  gamma - 562, 565
  suppression, by ceramic coatings - 51
Radioactive material, zircon, in soil - 826
  zirconium, by bombardment with moderated neutrons - 404
Radioactivity - 763
  absorption in body - 343, 344, 800, 889
  artificial - 632
  metabolism of fission products - 466
  production, by bombardment of neutrons - 762
  specific, of hafnium-zirconium ores - 129
Radioactivity studies, of zircon - 633
Radiochemical activity, analysis, modified method - 428
Radiochemical studies, isotopes of zirconium - 146
Radiochemistry - 621
Radiocolloids - 785, 793
Radioisotopes, fission produced, separation, ion exchange method - 888
Radiology - 348
Rare earths, electrochromatographic separation - 768
Rare-earth metals, economics - 607
Reaction vessel, zirconium lined, fabrication - 670
Reactions, alcohols on zirconium tetrachloride and chloride alkoxides - 67
  between ammonia and alcoholic solutions of zirconium sulfate - 239
  gas-metal, of zirconium - 321
  gas-phase - 528
  gases with metals - 140, 141
  metallurgical, fluorides - 474
  surface, nitrogen with beta zirconium - 564
  zircon and zirconia, in contact with various commercial refractories - 145
  zirconium, with gases - 323
  zirconium tetrabromide, in ammonia - 65
   with potassium - 961
Reactors - 968
  atomic, zirconium for - 454, 496, 611, 738, 806
  materials and equipment for - 663
  nuclear, zirconium for - 200, 221
  use of zirconium for - 459
Reagents, analytical, for colorimetric determination of zirconium or hafnium - 535
  for determination of zirconium - 920
  organic, for analysis of zirconium - 700
Recrystallization characteristics - 180
  crystal-bar zirconium, rolled - 390, 391
  texture, zirconium wire - 89
  zirconia refractories - 186
Reducibility - 529

Generated on 2024-09-20 18:07 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Reduction, hot wire - 575
vacuum, metallic oxides using zirconium - 558
zirconium chlorides - 435
zirconium chloride, with magnesium - 506
Refractory materials - 55, 116, 240, 297, 477, 561, 569, 614, 650, 652, 878, 965 (See also Ceramics)
determination of zirconium in - 410
for rocket motor construction - 831
oxides, conversion to suboxide form - 965
thermal diffusivity of - 220
physical properties - 684, 686, 695
preparation, progress - 684
properties and physical constants - 760
reaction of zircon and zirconia with - 145
shell molded, use of zirconia - 513
southern India - 712
thermal conductivity measurement - 657, 658, 659, 660
thermal expansion - 23, 651
uses of zircon and zirconia in - 115, 124, 489, 780, 883
volatilities - 636
zircon, for aluminum melting furnaces - 492
zirconia, liners for combustion chambers of rocket motors - 830
zirconium, solubility of - 661
Refractory metals, high-temperature properties - 675
Residues, nonmetallic, analysis - 849
Resin, amberlite absorbent removal of zirconium from - 427
Rigidity modulus, pure oxide bodies - 761
Rocks, occurrence of zirconium in - 884
Rutile, color and properties, effect of zirconium oxide on - 452

S

Salts, zirconium, properties - 744
Scaling, copper-base alloys - 896
Scattering properties, determination by neutron diffraction - 812
Scintilation spectrometer, use - 95
Sheath working, zirconium ingots - 367
Sigma phase - 834
Silica brick, spectrographic analysis - 752
replacement by alumina and zirconia in electrical porcelain - 895
Silicates, zirconium, cone fusion studies on - 716
specific heats at low temperatures - 473
synthesis - 235
Silver-zirconium alloys, analysis - 618
Sintering - 485
zirconium boride - 256
zirconium carbide - 534
zirconium columbates - 181
Sodium, aqueous solution, electrolysis - 71
Sol-gel transformation, kinetics - 177
Soldering - 777
Solubility - 522, 563, 793, 938
nitrogen and oxygen, in zirconium - 208
oxygen, in zirconium - 156
zirconia in soda-borosilicate glasses - 482

Generated on 2024-09-20 18:02 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Solubility
  zirconium oxide - 107
  zirconium oxide opacifier in glass - 15
  zirconium refractory monocarbides - 661
Spectra - 251, 647, 678
  auger-effect and intensity of L-emission lines - 159
  beta-ray - 642
  dispersion vSagittarii - 309
  infra-red, photography - 592
  mass, packing-fraction differences - 305
   zirconium - 20
  optical, hafnium - 347
  optical and atomic - 587
  X-ray, hafnium - 133
  structure - 871, 872
Spectrochemical analysis, hafnium and zirconium - 128
  zirconium - 641
  zirconium oxide - 833
Spectrochemical determination, hafnium-zirconium ratios - 214
Spectrographic analysis, hafnium in zirconium - 832
  zirconates - 355
  zirconium oxide - 752
Spectrographic determination, zirconium - 179
Spectrographic studies of zircon - 633
Spectrometer studies - 362
Spectrometric determination, beta particles - 666
Spectrophotometric determination - 414, 479
  silicon in zirconium - 98
  titanium and iron in zirconium - 42
Spectrophotometry, hafnium-alizarin lake - 536
Spectroscopy, infrared, zirconium concentrated - 338
Stainless steel, Type 316, corrosion properties - 945
Standard samples, analytical results and methods - 645
Steel, chromium, addition of zirconium sulfide to - 673
  determination of zirconium in - 244, 254, 461, 491, 821, 822
  effect of zirconium on - 867
  grain growth inhibitors in, 340, 341
Steel and iron alloys, substitution of zirconium for manganese - 24, 26, 451
  use of zirconium in - 24, 25, 399, 406
Stellite No. 6, corrosion properties - 945
Stress, high shearing - 79
Strontiate, zirconium, properties and metallurgy - 791
Structure - 88, 150, 335, 425, 580
  alkoxides, zirconium and hafnium - 70
  ammonium heptafluozirconate and potassium heptafluozirconate - 346
  electronic, of molecules and crystals - 204
  metallic carbides and nitrides - 431
  spectrum, hyperfine, zirconium - 871, 872
  tetrahalides, investigation by electron diffraction - 545
  zircon - 868
  zirconium alloys - 5
  zirconium-beryllium alloys - 32
  zirconium-molybdenum alloys - 184
Submarine, atomic-powered, use of zirconium in - 624

Generated on 2024-09-20 18:04 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Sulfate and oxide, zirconium, freeing of impurities - 118
detection of potassium by - 723, 724, 727
properties and constitution of - 744
reaction between ammonia and alcoholic solutions with 239
Sulfur, thermodynamic properties - 471
Superconductivity, measurement of - 95
Superconductors, properties - 835
Surface energies, calculation - 66, 484
preparation - 778
reaction of nitrogen with beta zirconium - 564
tension and wettability in metal-ceramic systems - 430
Swiss lavas, geochemistry - 12
Synthesis, zircon - 146
zirconium silicates - 235

T

Tanganyika, hafnium deposits - 843
Tank blocks, use of zirconium for - 676
Tannage, use of zirconium for - 842
Tantalum, as engineering material - 202
quantitative separation from zirconium - 4
corrosion properties - 899, 945
Tensile properties - 468, 796, 930
unalloyed zirconium - 393, 396
Tetrabromide, preparation, using carbon dioxide or nitrogen - 962
zirconium, reactions in liquid ammonia - 65
reaction with potassium - 961
Tetrachlorides, zirconium, action of alcohol on - 67
addition, with phosphorous oxyhalogen compounds - 523
hafnium, heat capacities and entropies - 667, 886
zirconium, chlorination - 864
heat capacities and entropies - 887
thermal decomposition - 409
vapor pressure - 772
with aluminum chloride as a Friedel-Crafts catalyst - 378
zirconium and hafnium, heats of formation - 432
vapor pressures - 509
Tetrafluorides, zirconium and hafnium, optical properties - 590
zirconium, preparation - 953, 954
sublimation - 1
Tetrahalides structure, investigation, by electron diffraction - 545
Tetraiodide zirconium, preparation - 216
Therapy, by zirconium citrate injections - 327
Thermal conductivity, measurement in zirconia, zircon, and zirconium oxide - 657, 658, 659, 660
refractory materials - 652
zirconia refractory bodies - 792
Thermal decomposition, zirconium tetrachloride - 105, 409
Thermal dissociation, zircon - 146
Thermal expansion - 253, 651
coefficients - 303, 756
refractory oxide, zircon - 23
zircon-calcium, zirconium silicate-clay - 838
zirconium columbates - 181
zirconium, X-ray investigation of - 810

Generated on 2024-09-20 18:02 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Thermal shock - 836
  annealing, effect on zircon body - 153
  zirconia, resistance to - 144
Thermionic emitters, use of zirconium in - 297, 328
Thermodynamic properties - 471
Thermoelectric power of the transition metals - 703
Thin films, zirconium oxide, electron and photocurrents - 106
  zirconium oxide, ionic currents - 107
Thorium, determination in high-grade and low-grade ores - 311
  oxide sulfides, discussion - 187
  production, recent developments - 859
  separation, ion exchange method - 82
  technology, advances - 859
Thorium oxide-cerium oxide, selective radiation of - 444
Tin, solid solubility, in alpha zirconium - 848
Tissues, reaction of zirconium metal chlorides on - 873
Titanium, as engineering material - 202
  casting - 52
  cathodic polerization characteristics, in sulfuric acid - 625-630
  corrosion properties - 899, 945, 956
  fabrication - 63
  heat capacities - 198
  industrial outlook - 929
  physical and mechanical properties - 520
  production, advanced methods - 899
   Germany - 704
  separation, Hillebrand method - 81
   ion exchange method - 82
  use - 572
  workability - 209
Titanium alloys, application to zirconium - 155
Titanium-zirconium alloys, allotropic transformation in - 183
Titanium-zirconium oxide and zirconium-zirconium oxide alloys, for coating
 materials - 783
Titrations, electrometric, of zirconium and hafnium - 522
Toxicity, zirconium compounds - 348, 350, 903, 904, 905
Transformation - 363, 586
  allotropic, in titanium-zirconium alloys - 183
  alpha-beta, in zirconium - 364
  alpha to beta of zirconium - 90
  rolled crystal bar zirconium - 390, 391
  zirconia - 361
  zirconium, habit plane of - 908
Transition - 620
  allotropic, zirconium alloys - 691
  zirconium, effect of oxygen and nitrogen on - 157
Tribromide, preparation - 960
Tritium-zirconium, targets for particle accelerators, preparation of - 743
Tumors, effect of zirconium chlorides on - 873
Tungsten, as engineering material - 202
  technology, advances - 859
Tungsten alloys, carbide free - 480
Tungsten filaments, electron emission - 182

Generated on 2024-09-20 18:02 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

U

Ugine-Séjournet process - 197
Ultrasonic pulse technique, for measuring elastic constants - 732
Uranium, oxide sulfides, discussion - 187
Uranium fission products, separation of zirconium from - 312
Uranium oxide-zirconium oxide system, equilibrium phases - 516
Uranium0thorium-zirconium ternary alloy system, studies - 99
Uranium-zirconium alloys, analysis of - 617
  determination of zirconium in - 320

V

Vacuum fusion, determination of oxygen in zirconium by - 854
Vacuum metallurgy process for industrial-scale zirconium production - 612
Vacuum reduction, metallic oxides, using zirconium for - 558
Vacuum service, high temperature materials for - 608
Vacuum techniques, metal coatings by - 260
Vacuum tubes, use of zirconium for - 424, 746
Vanadium, as engineering material - 202
Vapor phase esterification - 234, 493
Vapor pressure data - 476, 570
  determination, zirconium and hafnium tetrachloride - 120
  zirconium tetrachloride and hafnium - 509, 772
Volatilities of refractory materials - 636

W

Water-repellents, use of zirconium for - 58
Wave-length measurements, hafnium - 593
Welding - 802, 901
  ductile zirconium - 137
Wettability, metal-ceramic systems - 430, 485
Wire drawing and recrystallization texture, zirconium - 89

X

X-ray absorption - 966
X-ray diffraction studies, zirconium dioxide - 119
  zirconium-beryllium alloys - 32
X-ray investigations, zirconium hydrides - 330
X-ray polychromatic beams - 537
X-ray powder diffraction, hafnium - 247
X-ray spectra - 159
X-ray spectra, hafnium - 133
X-ray spectroscopy, analysis of zirconium - 635
X-ray studies, zirconium oxide, silicate melts - 35
X-rays, excited by beta particles - 189

Z

Zircon, alpha-radiation damage to - 437
  caustic treatment, in preparation of pure zirconium - 850
  ceramic material - 333, 780, 878
  ceramic research on - 199

Generated on 2024-09-20 18:02 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Zircon
chemical composition - 498
decomposition, by chlorination - 2
dielectrics - 837
deposits, Australia - 109, 599
Brazil - 230, 255
Florida - 307
Greenland - 440
Idaho - 526
electrostatic separation - 467
flotation - 112
insulation - 767
furnace linings - 123
furnace tubes, high vacuum systems - 322
hafnium content, effect on radioactivity - 129
history - 416, 878
industrial dust, by inhalation, cause of radiographic shadows - 348
optical studies - 633
porcelain, glaze for, - 555, 909
properties, uses, possibilities - 755
production figures, Australia - 710
properties - 145, 633
reactions, in contact with certain commercial refractories - 145
refractories, uses - 124
research, Australia - 113
sand, adherence to steel castings - 46
ductile zirconium from - 508
structure - 868
thermal conductivity, measurement - 659
uses - 416
Zircon bodies, cyclic heating and cooling - 610
effect of thermal shock and annealing on - 153
strength characteristics, effect of alumina hydrate additions on - 840
Zircon carbide, effect with titanium carbide on gas-turbine-blade performance - 408
Zirconates, coseparation - 249
sol formation - 669
spectrographic analysis - 355
piezoelectric properties - 839
Zirconia, additions to enamels for steel - 958
ball milling - 782
catalyst, for aromatization of n-heptane - 211
for production of butadiene - 891
ceramic ware - 94
crucibles, preparation - 942
crystal modifications - 121
effect on chemical durability of borosilicate glasses - 412
effect on elasticity of soda-lime glasses - 413
films, liners for combustion chambers of rocket motors - 829
fused stabilized - 306
hafnium-free, preparation - 521
heat transfer rates - 145
hydrogel - 436
in Colorado pitchblende - 232
monoclinic lattice - 111
oxide additions, effect on thermal changes of - 245

Generated on 2024-09-20 18:05 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Zirconia
porosity - 759
porous sintered, strength characteristics - 759
properties, preparation, fabrication - 145, 334, 944
purification, electric arc furnace - 568
refractories - 124, 489, 569
properties - 943
recrystallization - 186
uses - 124
refractory materials, thermal conductivity - 55
refractory oxides - 614
liners, combustion chambers of rocket motors - 830
rigidity modulus - 761
solubility, in soda-borosilicate glasses - 482
thermal conductivity, measurement - 657, 658
thermal diffusivity of - 220
thermal shock, resistance - 144
use - 944
use as porcelain - 246
use for shell molded refractories - 513
use in electrical porcelain - 895
Zirconia-alumina-silica systems, glass melts in - 31
Zirconia-ceria system, phase relationships - 185
Zirconia-magnesia spinel system - 574
Zirconia-silica system, melting point diagram - 933
Zirconium, adsorption properties - 424
alpha to beta transformation - 90, 364
analysis - 698
organic reagents for - 700
aqueous solution, electrolytic studies - 310
behavior, compared with hafnium - 111
cathodic polerization characteristics, in sulfuric acid - 625-630
chemistry - 906
cold-rolled, thermal reorientations, kinetics - 583
compared with iron and titanium - 794
corrosion properties - 573, 945, 956
determination, arsenate method - 787
in fusion, oxalate method - 72
discussion - 7, 29, 104, 335, 399, 450, 573, 600, 766, 884, 937, 963, 969
economics - 607
extraction, methods - 601
fabrication - 63, 299
fatigue properties - 801
fission activities - 132, 463
fractional separation, by extraction with thenoyltrifluoroacetone - 419, 524, 525
general properties - 325
hafnium content, determination, spectrographic method - 634, 751
heat capacities - 198, 722, 851, 827, 449
heat resistance - 372
heating in oxygen, nitrogen, and air - 368
high purity - 546
history - 104
industrial outlook - 929
metallurgy - 373, 601, 602, 714
microstructure - 930

Generated on 2024-09-20 18:02 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Zirconium
  optical properties - 590
  polymerization - 127
  present status - 926
  prices - 969
  production - 104, 154, 164, 577, 662, 708, 714, 806, 856, 857, 859
   electrolytic process - 476
   fused metal electrolysis - 541, 713, 813-818
   heat wire process - 409, 575
   vacuum melting furnace - 571
   vacuum metallurgy - 612
Zirconium-hafnium system, equilibrium diagram - 207
Zirconium-hydrogen system, stability - 789
Zirconium ingots, sheath working - 367
Zirconium-iron alloys, mechanical properties - 370
Zirconium-manganese system, phase diagram - 737
Zirconium-molybdenum system, metallographic analysis - 168
Zirconium-nickel system, phase diagram - 371
Zirconium nitride, heat capacities - 887
Zirconium-nitrogen reactions, at high temperature, kinetics - 174
Zirconium oxide, production - 10, 445
  thin films, ionic currents in - 106, 107
Zirconium oxide-calcium iodide system, phase diagram - 47
Zirconium oxide-silicon dioxide system, equilibrium studies - 845
  phase relations - 846
Zirconium oxide-titanium dioxide system, phase equilibrium studies - 845
  phase relations - 846
Zirconium-oxide sulfides, discussion - 187
Zirconium oxychloride, production - 445
Zirconium-oxygen system, melting point, composition diagram of - 140
Zirconium phosphate bodies, physical properties - 685
Zirconium potassium fluoride, production - 445
Zirconium powder, production, electrochemical - 225
Zirconium reactions, kinetics - 321
Zirconium silicate, heat capacities - 473
Zirconium sponge, production - 867
Zirconium tetrachloride, with phosphorus oxyhalogen compounds - 523
  heat capacities - 887
Zirconium tetrachloride-sodium chloride system, phase diagram - 47, 476
Zirconium-tin alloys, properties, effect of hydrogen on - 637
Zirconium-titanium system, transition point diagram - 210
Zirconium-wolfram, metallographic analysis - 168
Zirconyl chloride, hydrolysis of - 917
Zirconyl compounds, preparation - 918
Zirconyl precipitants for acid dyestuffs - 59
Zirconyl sulfates, aqueous solutions, electrolysis - 71
  hydrolysis of - 917
Zirkite, purification, in electric furnace - 882

Generated on 2024-09-20 18:01 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

PATENT SUBJECT INDEX

A

Acylation, thiophene - 235
Additives See Alloying agents.
Alkyphenols, dealkylation - 352
Alloying agents - 167, 408, 421
Alloys - 85, 86, 101, 136, 168, 242, 490, 606
  cutting metal - 23
  dental - 71
  heat resistant - 219
  high-temperature applications - 246
  hot workable - 449
  improvements - 100
  magnesium-base - 265
  magnetic - 4, 191, 230, 231, 518
  metal - 214, 370
   production, process - 52
  manufacture - 602
   improvements - 527, 538
  master, for introduction of zirconium into magnesium - 30
  noncorrosive, high tensile strength - 494
  production, process - 177, 215-217, 349, 412
  tool - 491-493
  zirconium, production, process - 48, 50, 605
Aluminum alloys, containing zirconium - 281, 542, 622
Aluminum-base alloys, physical properties - 248
Aluminum brasses, containing zirconium - 72
Aluminum-chromium-zirconium alloy - 96
Aluminum-magnesium alloys - 8
Aluminum ores, treatment - 258
Ammonium zirconium sulfate salt, preparation, process - 61
Animo-diphenyl-propanol - 137
Aromatic compounds, production - 153, 154, 541

B

Beryllium alloys - 504
Beryllium-aluminum alloys - 515
Benches, double track - 411
Butadiene, manufacture - 641

C

Calcined products, treatment - 273
Calcium oxide-chromium oxide-zirconium oxide refractories - 447
Calcium oxide-zirconium oxide refractories - 448
Carbide, containers, production, process - 637
Carbides, zirconium, general - 234
  zirconium, in alloys - 417
Carboxides, zirconium, production, process - 307

Generated on 2024-09-20 18:08 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Castings, nickel-copper alloys - 388
refractory materials - 105, 158, 180, 181, 182-185, 194, 202, 341, 342, 487, 643
zirconia - 200
Catalysis - 45, 46, 67
Catalysts - 406, 640
alumina, for conversion of hydrocarbons - 129
for cracking oils - 99
hydrocarbons - 547
hydrogenation - 454
manufacture - 126, 336
nickel-zirconium, preparation - 238
for production of carbon disulfide, reaction of hydrocarbons - 186
revivification - 261
silica-alumina-zirconia, preparation - 548
silica-zirconia, preparation - 531
synthesizing - 582
zirconium oxyfluoride, for conversion of hydrocarbons - 129
Catalytic dehydrogenation, hydrocarbons - 516, 536
Catalytic production, aromatic compounds - 153
Catalytic reconstruction, hydrocarbons - 188
Catalytic treatment, hydrocarbons - 535
Cathodes, fabrication,process - 437
Caustic fusion, zircon - 69
Cement, lamp basing - 78
Ceramics, metallizing, method - 80
opaque, enamel for, preparation - 525
slip casting, form, production - 496
See also Refractory materials
Ceramic articles, casting - 460
Ceramic compositions - 68, 609
Ceramic dielectrics - 469, 638
Ceramic insulating bodies - 639
Ceramic pigments - 503
Ceramic sealants - 74, 162, 409, 546
Ceramic stains, process for - 159
Chlorides, metal, liquid, purification - 190
volatile, decomposition - 486, 487
metallic, puridication - 494
zirconium, production - 329
Chlorination, oxidized ores - 494
Chromatographic adsorption, processes for separation and purification of materials - 260
Chromium alloys - 431
Circuit interrupter - 33
Citrates, zirconium - 214
Coatings, application, on metals - 396
by evaporating metals - 104
on iron and steel - 489
phosphate, on metal surfaces - 271
polyvinyl alcohol - 360
refractory - 167, 467, 642
zircon, to nonemissive electrodes - 635
zirconium, for electron discharge devices - 629
on metal - 392
Cobalt alloys - 63, 186

Generated on 2024-09-20 18:07 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Colloids - 85
  electrolytic, manufacture - 84
Contact - 241
Conversion, catalytic, hydrocarbon oils - 406
  fluid reactants - 254
  hafnium and zirconium phosphates - 133
  hafnium and zirconium phosphates to hafnium and zirconium compounds, process - 428
  hafnium and zirconium salts - 135
  hydrocarbons, process - 365, 464, 581
  hydrocarbon oil - 1, 337
  See also Catalytic conversion.
Copper alloys - 244
  application to electrical conductors - 249
Copper-base alloys - 233, 245, 282
Copper ores, treatment - 258
Copper-zirconium alloys, manufactured parts of - 222
Copper-zirconium-manganese alloy - 243
Cracking oil catalysts - 99
Crucibles, carbide - 332
  temperature resistant - 534

D

Decomposition, hydrocarbons - 505
  volatile metal chlorides - 486, 487
  zirconium, in cycle by means of sulfuric acid - 127
  zirconium ores - 142, 321, 544
Dehydrogenation, hydrocarbons - 345
  See also Catalytic dehydrogenation.
Dental alloys - 71
  uses - 192
Deodorants - 599, 618
Dielectrics, ceramic, production, process - 469, 638
  materials, production, process - 626
Dihalides, production - 269
Dimeric octadecadienonitrile - 77
Diolefins, production, process - 367, 577
Discharge device, electrical - 10
Discharge tubes, electrical - 156
Dye pigment - 60

E

Electrical filaments - 432
Electrical lamp filaments, tungsten alloys for - 73
Electrical lamps - 208
Electrical conductors, application of copper alloys to - 249
Electrical discharge device - 10
Electrical discharge tube - 156, 250
Electrical heating resistance - 601
Electrical measuring device - 41
Electrical resistance element - 169
Electrodes - 157
  cutting and welding under water - 256

Generated on 2024-09-20 18:06 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Electrodes
  emissive - 353
  nickel alloy - 434
Electron discharge devices, zirconium coating for - 630
Electronic tubes - 436
Electrophoresis, process of - 526
Electrostatic separation - 170
Enamel opacifiers - 25, 26
Enamels, for opaque ceramics, using zirconium oxide - 525
  sintered, preparation of, opacified by zirconium compounds - 348
  vitreous, opacification - 285
   preparation of - 574

F

Ferro-aluminum, zirconium alloys - 97
Ferrous alloys - 251, 550, 584
Ferrozirconium, low-carbon, production - 509
  process for - 371
Filament bodies - 441
Flash lamp - 482
Fluid reactants, conversion - 254
Fluorides, metal, for use in contact with teeth - 361
  zirconium, anhydrous, production - 9
Fluozirconates, production - 279
Flux-forming fuels - 2
Foundry molds - 227
Fuel, antiknock, production - 644
  burner and flame spreader - 600
  flux-forming - 2
Furnaces, lining, temperature resistant - 534
  arc melting - 530
Fuse powder, composition - 226

G

Gels, zirconium, use in conversion of hydrocarbons - 565
Getters, zirconium - 436
Glass, composition - 549
  furnaces, electrolytic method of protecting wall - 420
   refractories for - 98
  optical - 15, 16, 106, 138
  silicate, containing zirconia - 386
  wool, refractory - 375
Glazing compositions, refractory materials - 444
Gold-zirconium alloys - 221
  zirconium alloys, application of - 223

H

Hafnium, deposition - 433
  on refractory material core - 440
Hafnium alloys, molten state, treatment - 325
Hafnium and zirconium salts, dissolution - 23
Hafnium phosphate mixtures, dissolution - 21, 427

Generated on 2024-09-20 18:07 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Halide vapors, metal, separation - 322
Halides, metallic anhydrous, process for - 150
Heat treatment, alloys - 483
Hydrides, metal, alkaline earth, use in reduction of refractory oxides - 3
  zirconium, production - 6, 377
Hydrocarbon oils, catalytic conversion - 1, 337, 406
Hydrocarbons, catalyst for production of carbon disulfide, by reaction of - 186
  catalytic conversion - 205, 363, 535, 547, 581
  catalytic dehydrogenation - 516, 536
  catalytic reconstruction - 187
  catalytic treatment - 535
  conversion, presence of catalyst alumina and zirconium oxyfluoride - 128
   process - 464
  conversion, use of zirconium gels - 365
  decomposition - 505
  dehydrogenation - 345
  isomerization - 443
  manufacture - 93, 94
  polymerization - 218
Hydrogels, treatment - 509
Hydrogen halides, removal, from gaseous effluents - 338
Hydrogenation catalysts - 454
Hydrolysis, for production of amphoteric hydrated oxides - 390

I

Insulating bodies, ceramic, process for - 629
  heat - 393
  porcelain - 151
Iodide, zirconium, production - 514
Iron, cast, manufacture - 400, 401, 513
  pipe, cast - 334
Iron steel alloys, processes for - 580
Iron-zirconium-silicon alloys - 419
Iron-zirconium, titanium alloys - 508
Isomerization, hydrocarbons - 443
  removal of hydrogen halides from gaseous effluents, process - 338
Isoparaffins, preparation - 66

L

Lactate salts and lactic acid, process - 613
Lamination, process - 403
Lead and zirconium, pyrophoric alloys - 12
Lead-zirconium-silicate, process for - 300
Leather, use of zirconium on - 170, 363

M

Machine elements - 287
Machining metals - 607
Magnesium alloys - 27, 28, 31, 165, 264, 265, 358, 369, 527
  containing zirconium, heat treatment - 35, 483
  production - 357, 359, 532
Magnesium-base alloys, treatment to resist corrosion - 210

Generated on 2024-09-20 18:02 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Magnesium orthostannate - 323
Magnesium-zirconium alloys - 484
  process for - 34, 156, 166
Magnetic alloys - 4, 191, 230, 231, 518
Magnets, anisotropic Alnico - 540
Manual switches - 384
Measuring devices, electrical - 41
Medical, artificial replacement parts within body, including dentures - 192
Melting, reactive metals - 583
Mercaptans, process for production from olefins and hydrogen sulfide - 501
Mercury vapor tubes - 627
Metals, difussion into iron and steel - 481
  extraction from their compounds, improvements - 82, 82, 187
  treatment - 49, 257
Metal bodies, core and shell type - 586
  preparation - 257
  production - 635
  refining - 495
  surfaces, phosphate coatings on - 263
  treatment - 49
  zirconium, process for - 174, 604
  zirconium, recovery by thermal reduction of zirconium chloride - 603
Metal sulfates, dissolution - 11
Mineral sands, treatment - 104, 105
Minerals, zirconium treatment of - 645
Molding and molds, zirconia - 36, 220, 463
Molybdenum-tungsten-carbon alloys, iron-free smelting - 331
Molybdenum-zirconium alloys - 229

N

Neutrons, generating, process for - 232
Nickel alloy electrodes - 434
Nickel-copper alloys, casting - 388
Nickel-steel alloys - 405
Nickel-zirconium alloys - 418
Nickel-zirconium catalyst, preparation - 238
Nitrate, zirconium, production - 7, 561
  zirconium, process for - 320
Nitrogen compounds, preparation - 502

O

Olefinic distillate, reduction of olefin content - 225
Olefins, production - 280
Opacifiers - 285, 303, 347, 348, 624
  enamel - 25, 26
  zirconia - 259
Organo-metallic compounds, production - 560
Oxides, metal, process for - 488
  metallic, bodies of - 461, 462
   porous objects of - 512
   fused process for - 123
  preparation and production - 452
  zirconium, conversion in plastic condition - 148, 149

Generated on 2024-09-20 18:05 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Oxides
zirconium, enamel for opaque ceramics - 525
heat resistant - 146
manufacture of articles from - 479
objects and utensils, preparation - 145
polishing material - 379
preparation - 374, 380, 564, 572, 616
process for - 91, 305, 308-310, 521, 555
production and manufacture - 58, 102, 277, 289, 489, 500
purification - 70
recovery - 209, 467, 477
recovery from minerals - 278
refractories, process for - 569, 608, 613
refractory products containing - 339, 340
separation from zircon - 520
silica, process for - 292
treatment - 565
Oxide gels, inorganic, drying - 364
Oxide ores, acidic, alkaline roasting of - 360
Oxychloride, zirconium, process for - 172, 472
zirconium and silicon carbide, preparation - 306

P

Particles, homogenous, separation of preferred fractions - 459
separation and classification - 631
treatment of material for - 253
Periclase, preparation - 19
Photoelectric devices - 465
Photographic processes - 161
Phthalocyanines, metal, process for - 402
Pigments, ceramic - 63, 286, 503
dye - 60
Polishing material - 381
zirconium oxide for - 379
Polyazodyes - 121
Polymerization, hydrocarbons - 218
Polyvinyl alcohol coatings, gelling - 351
Potassium fluozirconates, production - 65
Powders, metal - 5, 228
Precipitation, hafnium and zirconium - 430
zirconium compound - 333
Projectors - 621
Purification - 22, 252, 335, 350, 610
liquid metal chlorides - 190
refractory compounds - 566
zircon - 551
zirconium compounds - 562, 563
zirconium oxide - 70
Pyrophoric alloys, lead and zirconium - 12
zirconium, lead and titanium - 13

R

Radioactive materials, preparation - 442
Rare metals, preparation - 362

Generated on 2024-09-20 18:08 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Recovery - 84, 124, 125
liquid or solid components - 533
refractory metals - 236
zirconium and hafnium - 22
zirconium metal by thermal reduction of zirconium chloride - 603
zirconium oxide - 43, 209, 467, 477
from minerals - 278
zirconium salts, from siliceous zirconium ores - 552
Refining metals - 495
zirconium-containing ores - 475
Refractory materials - 81, 207, 213, 268, 312, 317
bonded - 313
calcium oxide - 237
calcium oxide-chromium oxide-zirconium oxide - 447
calcium-oxide, zirconium-oxide 448
casting - 105, 158, 179, 180, 182-185, 193, 194, 202, 341, 342, 460, 643
clay - 398, 399
coatings for - 458
composition - 457, 571, 576, 612, 628, 629
composition, process - 318, 558, 559, 570, 615
containing zirconium oxide - 339, 340
depositing zirconium and hafnium on core - 440
glass furnaces - 198
glass wool - 376
glazing compositions for - 444
high temperature - 391
improved - 51, 506
insulating - 554
mass - 264
molding - 37
molds - 556
porous - 319, 392, 397
preparation - 519, 534, 568
process for - 240, 408, 414, 543, 557
production and manufacture - 18, 141, 181, 199, 314, 315, 354-356, 378, 396, 423, 522, 619, 642
purification - 566
recovery - 236
reduction - 344, 413
reduction, use of alkaline earth metal hydrides - 3
refining - 47
silicon carbide - 407
bricks and blocks - 445
tubes - 382
zircon, process for - 55, 385, 498, 517, 553
zirconia-alumina - 197
zirconia-alumina casting - 203
zirconia casting - 195, 196, 201, 204
zirconia-zircon-silicon - 396
zirconium - 395
zirconium compound, preparation - 160
zirconium oxide - 608, 145
zirconium oxide, process for - 569, 613

Generated on 2024-09-20 18:10 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

S

Salts, metals and alloys, preparation - 262
zirconium, vat colors - 376
of water-insoluble fatty acids, process for - 316
zirconium and hafnium - 129
zirconium recovery of, from siliceous zirconium ores - 552
Scale, removal, from zirconium metal - 152
Sealants, ceramic - 74
Separation, electrostatic - 170
liquid or solid components - 533
metal halide vapors - 322
metals - 330
suspended matter - 625
water-soluble, double-fluoride-forming metals - 53
zircon from other elements - 44
zirconium and hafnium - 103, 104, 107-120, 130-132, 134, 252, 255, 424-427, 429, 431, 450, 451, 468, 539, 586, 594
zirconium oxide from zircon - 520
Separation and extraction - 211
Silica-aluminum-zirconium catalyst, preparation - 548
Silica-zirconia catalyst, preparation - 531
Silica-zirconia gel, preparation - 56
Silicates, zirconium, porous - 298
process for - 299, 301, 302
production - 207
Silicon-zirconium alloys, preparation - 176
process for - 163
Silicon carbide, preparation - 306
Silicon carbide refractory - 407
Silicon carbide-zirconium, alkali acid solution, stabilization of - 296
alkali metal, process for - 295
Silver-zirconium alloys - 220
Sintered bodies, production from metallic oxides - 511
Slip casting ceramics - 496
Soldering metals - 438
Stabilization, vinyl halide polymers - 634
zirconium, silicon alkali acid solution - 296
Steam power plants - 366
Steels, alloys - 585
treatment - 89
zirconium, production - 510
Styrenes, production - 155
Sulfates, metal, dissolution - 11
zirconium, manufacture - 88, 415
process for - 455, 473, 578
sodium, process for - 523

T

Tanning - 368, 529
process for - 173
Tartrates, zirconium, process for - 294
Tetrachloride, zirconium anhydrous, production - 324
zirconium, preparation - 633
process for - 62, 632

Generated on 2024-09-20 18:55 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Tetrahalide, zirconium anhydrous, process for - 188
Textiles, treatment - 588
  waterproofing, use of zirconyl compounds - 589
Thiophene, acylation - 235
Titania-zirconia, fused - 64
Titanium alloys, process for - 327
Titanium oxides, production - 57
Tool alloys - 491-493
Tungsten alloys, for electric lamp filaments - 13

V

Vaporization - 587
Vapor tubes, mercury - 627
Vitreous bodies - 446

W

Waterproofing, textiles, use of zirconyl compounds - 589
Welding, underwater, electrodes for - 256

Z

Zircon, caustic fusion - 69
  coatings, to nonemissive electrodes - 636
  pebbles, mullite-bonded - 470
  purification - 551
  refractories, process for - 385, 498, 517, 553
  sand, treatment - 20
  separation from other elements - 44
  testing process - 528
Zircon-calcium ignition products, treatment - 272
Zirconia, casting - 200
  casting refractories - 195, 196, 201, 204
  containing catalysis - 67
  extraction from ores, process - 545
  hydrous, pharmaceutical composition - 59
  molding - 36
  opacifiers - 259
  ores, extraction - 545
  production - 21, 92
  quenching - 39
  stabilized, process - 38
Zirconia-alumina refractories - 197
Zirconia-aluminum casting refractories - 203
Zirconia-zircon-silicon refractories - 395
Zirconic acid, meta, preparation - 499
Zirconium - 224, 239, 235, 389, 456
  compounds, composition - 42
   for vitamin B_{12} purification - 346
   precipitation - 333
   preparation - 567, 601, 611
   production - 79, 155, 471, 476, 478, 579
    process - 40, 139, 140, 288, 290, 291, 524
   purification - 562, 563
   recovery - 575

Generated on 2024-09-20 18:16 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Zirconium
removal of iron oxide or salt from - 87
lakes, process - 620
metal, manufacture - 343, 439
preparation - 284
deposition - 433
on refractory material core - 449
Zirconium alloys, molten state, treatment - 325
Zirconium and hafnium compound, manufacture - 211, 573
Zirconium-calcium ignition products, treatment - 272
Zirconium dioxide, preparation - 304
production - 474
Zirconium-lead alloy, production - 416
Zirconium-lead-titanium, pyrophoric alloys, production - 13
Zirconium-lime products - 270
Zirconium metal, dissociation, methods - 147
Zirconium minerals, treatment - 645
Zirconium ores, decomposition - 142, 544
digestion - 144, 271
dissociation, process - 466
treatment - 260, 267
Zirconium oxide, preparation - 378, 616
treatment - 565
Zirconium oxycarbide, preparation - 306
Zirconium phosphate mixtures, dissolution - 427, 592
Zirconium salts and hafnium, dissolution - 594
Zirconium-tungsten alloys - 276
Zirconyl compounds, waterproofing textiles with - 589
Zirconyl and hafnium compounds - 617

INT.-BU.OF MINES,PGH.,PA. 7955

Generated on 2024-09-20 18:01 GMT / https://hdl.handle.net/2027/osu.32435030643530
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from
THE OHIO STATE UNIVERSITY